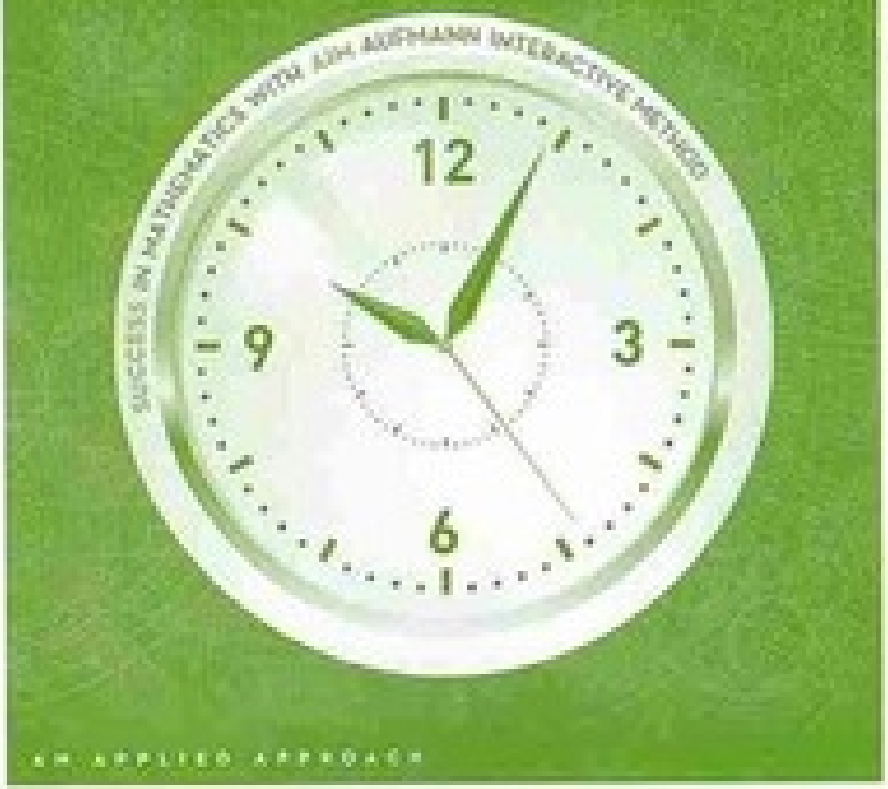
Student Solutions Manual

AUFMANN & LOCKWOOD

BASIC COLLEGE MATHEMATICS 10



AN APPLIED APPROACH

CARRIE GREEN

Student Solutions Manual

Basic College Mathematics
An Applied Approach

TENTH EDITION

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Chapter 1: Whole Numbers

Prep Test

1. 8

2. 1 2 3 4 5 6 7 8 9 10

3. a and D; b and E; c and A; d and B; e and F; f and C

Section 1.1

Concept Check

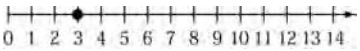
1a. False

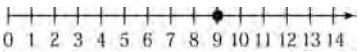
b. True

c. True

d. True

Objective A Exercises

3. 

5. 

7. $37 < 49$

9. $101 > 87$

11. $2701 > 2071$

13. $107 > 0$

15. Yes

Objective B Exercises

17. Three thousand seven hundred ninety

19. Fifty-eight thousand four hundred seventy-three

21. Four hundred ninety-eight thousand five hundred twelve

23. Six million eight hundred forty-two thousand seven hundred fifteen

25. 357

27. 63,780

29. 7,024,709

Objective C Exercises

31. $5000 + 200 + 80 + 7$

33. $50{,}000 + 8000 + 900 + 40 + 3$

35. $200{,}000 + 500 + 80 + 3$

37. $400{,}000 + 3000 + 700 + 5$

39. No

Objective D Exercises

41. 850

43. 4000

45. 53,000

47. 630,000

49. 250,000

51. 72,000,000

Critical Thinking

53. No. Round 3846 to the nearest hundred.

Section 1.2

Concept Check

1. Addition Property of Zero

3. Associative Property of Addition

5. Commutative Property of Addition

Objective A Exercises

7. 28

9. 125

11. 102

13. 154

15. 1489

17. 828

19.
$$\begin{array}{r} {\scriptstyle 1} \\ 859 \\ +\ 725 \\ \hline 1584 \end{array}$$

21.
$$\begin{array}{r} {\scriptstyle 1\,1\,1} \\ 36{,}925 \\ +\ 65{,}392 \\ \hline 102{,}317 \end{array}$$

23.
$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 50{,}873 \\ +\ 28{,}453 \\ \hline 79{,}326 \end{array}$$

25.
$$\begin{array}{r} {\scriptstyle 2\ 2} \\ 878 \\ 737 \\ +\ 189 \\ \hline 1804 \end{array}$$

27.
$$\begin{array}{r} {\scriptstyle 1} \\ 319 \\ 348 \\ +\ 912 \\ \hline 1579 \end{array}$$

29.
$$\begin{array}{r} {\scriptstyle 1\,2} \\ 9409 \\ 3253 \\ +\ 7078 \\ \hline 19{,}740 \end{array}$$

31.
$$\begin{array}{r} {\scriptstyle 1\,2} \\ 2038 \\ 2243 \\ +\ 3139 \\ \hline 7420 \end{array}$$

33.
$$\begin{array}{r} {\scriptstyle 1\,1\,1\,1} \\ 67{,}428 \\ 32{,}171 \\ +\ 20{,}971 \\ \hline 120{,}570 \end{array}$$

35.
$$\begin{array}{r} {\scriptstyle 1\,1\,1} \\ 76{,}290 \\ 43{,}761 \\ +\ 87{,}402 \\ \hline 207{,}453 \end{array}$$

37.
$$\begin{array}{r} {\scriptstyle 1\,1\,1} \\ 20{,}958 \\ 3{,}218 \\ +\ 42 \\ \hline 24{,}218 \end{array}$$

39.
$$\begin{array}{r} {\scriptstyle 1\,1\,1} \\ 392 \\ 37 \\ 10{,}924 \\ +\ 621 \\ \hline 11{,}974 \end{array}$$

41.
$$\begin{array}{r} {\scriptstyle 1\,2\,2} \\ 294 \\ 1029 \\ 7935 \\ +\ 65 \\ \hline 9323 \end{array}$$

43.
$$\begin{array}{r} {\scriptstyle 1\,1\ \ 2\,1} \\ 97 \\ 7{,}234 \\ 69{,}532 \\ +\ 276 \\ \hline 77{,}139 \end{array}$$

45.
$$\begin{array}{r} {\scriptstyle 1\ \ 1} \\ 9874 \\ +\ 4509 \\ \hline 14{,}383 \end{array}$$

47.
$$\begin{array}{r} {\scriptstyle 1\,1\,1} \\ 3487 \\ +5986 \\ \hline 9473 \end{array}$$

49.
$$\begin{array}{r} {\scriptstyle 1\ \ 1\,1\,1} \\ 9678 \\ +23{,}569 \\ \hline 33{,}247 \end{array}$$

51.
$$\begin{array}{r} {\scriptstyle 1\,1\,1}\\ 4579\\ +479\\ \hline 5058 \end{array}$$

53.
$$\begin{array}{r} {\scriptstyle 1\,2}\\ 659\\ 55\\ +1278\\ \hline 1992 \end{array}$$

55.
$$\begin{array}{r} {\scriptstyle 1\,1\,2}\\ 34\\ 329\\ 8\\ +67{,}892\\ \hline 68{,}263 \end{array}$$

57.
$$\begin{array}{rcr} 1234 & \approx & 1200\\ 9780 & \approx & 9800\\ +\ 6740 & \approx & +\ 6700\\ \hline \text{Cal.: } 17{,}754 & & \text{Est.: } 17{,}700 \end{array}$$

59.
$$\begin{array}{rcr} 241 & \approx & 200\\ 569 & \approx & 600\\ 390 & \approx & 400\\ +\ 1672 & \approx & +\ 1700\\ \hline \text{Cal.: } 2872 & & \text{Est.: } 2900 \end{array}$$

61.
$$\begin{array}{rcr} 32{,}461 & \approx & 32{,}000\\ 9{,}844 & \approx & 10{,}000\\ +\ 59{,}407 & \approx & +\ 59{,}000\\ \hline \text{Cal.: } 101{,}712 & & \text{Est.: } 101{,}000 \end{array}$$

63.
$$\begin{array}{rcr} 25{,}432 & \approx & 25{,}000\\ 62{,}941 & \approx & 63{,}000\\ +\ 70{,}390 & \approx & +\ 70{,}000\\ \hline \text{Cal.: } 158{,}763 & & \text{Est.: } 158{,}000 \end{array}$$

65.
$$\begin{array}{rcr} 67{,}421 & \approx & 70{,}000\\ 82{,}984 & \approx & 80{,}000\\ 66{,}361 & \approx & 70{,}000\\ 10{,}792 & \approx & 10{,}000\\ +\ 34{,}037 & \approx & +\ 30{,}000\\ \hline \text{Cal.: } 261{,}595 & & \text{Est.: } 260{,}000 \end{array}$$

67.
$$\begin{array}{rcr} 281{,}421 & \approx & 280{,}000\\ 9{,}874 & \approx & 10{,}000\\ 34{,}394 & \approx & 30{,}000\\ 526{,}398 & \approx & 530{,}000\\ +\ 94{,}631 & \approx & +\ 90{,}000\\ \hline \text{Cal.: } 946{,}718 & & \text{Est.: } 940{,}000 \end{array}$$

69. Commutative Property of Addition

Objective B Exercises

71. **Strategy** To find the total number of multiple births, add the four amounts (138,600 5877, 345, and 46).

Solution
$$\begin{array}{r} 138{,}660\\ 5877\\ 345\\ +\ 46\\ \hline 144{,}928 \end{array}$$

There were 144,928 multiple births during the year.

73. **Strategy** To find the total gross income from the eight *Harry Potter* movies, add the eight amounts.

Solution
$$\begin{array}{r} 317{,}600{,}000\\ 262{,}000{,}000\\ 249{,}500{,}000\\ 290{,}000{,}000\\ 292{,}000{,}000\\ 302{,}000{,}000\\ 296{,}000{,}000\\ +\ 381{,}000{,}000\\ \hline 2{,}390{,}100{,}000 \end{array}$$

The total gross income from the eight *Harry Potter* movies was $2,390,100,000.

75. **Strategy** To find the total gross income from the two highest-grossing *Harry*

Potter movies, add the income from *Sorcerer's Stone* ($317,600,000) and *Deathly Hollows: Part II* ($381,000,000).

Solution

$$\begin{array}{r} 317{,}600{,}000 \\ +\ 381{,}000{,}000 \\ \hline 698{,}600{,}000 \end{array}$$

The total gross income was $698,600,000.

77a. Strategy To find the total number of miles driven during the three days, add the three amounts (515, 492, and 278 miles).

Solution

$$\begin{array}{r} 515 \\ 492 \\ +\ 278 \\ \hline 1285 \end{array}$$

1285 miles will be driven during the three days.

b. Strategy To find what the odometer reading will be by the end of the trip, add the total number of miles driven during the three days (1285) to the original odometer reading (68,692).

Solution

$$\begin{array}{r} 68{,}692 \\ +\ 1285 \\ \hline 69{,}977 \end{array}$$

At the end of the trip, the odometer will read 69,977 miles.

79. Strategy To find the total number of barrels, add the number of barrels produced (5,633,000) to the number of barrels imported (9,003,300).

Solution

$$\begin{array}{r} 5{,}633{,}000 \\ +\ 9{,}003{,}300 \\ \hline 14{,}636{,}300 \end{array}$$

The total number of barrels produced and imported per day is 14,636,300.

Critical Thinking

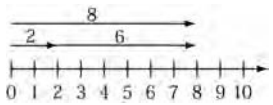
81. No; 0 + 2 = 2

83. Answers will vary. For example:

A part-time instructor is teaching two classes this term, with 34 students in one class and 28 students in the other. How many students is the part-time instructor teaching this term? 62 students.

Projects or Group Activities

85.



Section 1.3

Concept Check

1. 4; 5 + 4 = 9

3. 11; 0 + 11 = 11

Objective A Exercises

5. 4

7. 9

9. 22

11. 60

13. 66

15. 31

17. 901

19. 791

21. 1125

23. 3131

25. 47

27. 925

29. 4561

31. 3205

33. 1222

35. 5 and 3: 5 – 3 = 2, and 5 + 3 = 8

Objective B Exercises

37.
$$\begin{array}{r} {\scriptstyle 6\ 11} \\ \not{7}\not{1} \\ -\ 18 \\ \hline 53 \end{array}$$

39.
$$\begin{array}{r} {\scriptstyle 3\ 17} \\ \not{4}\not{7} \\ -\ 18 \\ \hline 29 \end{array}$$

41.
$$\begin{array}{r} {\scriptstyle 2\ 17} \\ \not{3}\not{7} \\ -\ 29 \\ \hline 8 \end{array}$$

43.
$$\begin{array}{r} {\scriptstyle 6\ 10} \\ \not{7}\not{0} \\ -\ 33 \\ \hline 37 \end{array}$$

45.
$$\begin{array}{r} {\scriptstyle 1\ 4\ 10} \\ \not{2}\not{5}\not{0} \\ -\ 192 \\ \hline 58 \end{array}$$

47.
$$\begin{array}{r} {\scriptstyle 6\ 16} \\ \not{7}\not{6}8 \\ -\ 194 \\ \hline 574 \end{array}$$

49.
$$\begin{array}{r} {\scriptstyle 6\ 14} \\ 6\not{7}\not{4} \\ -\ 337 \\ \hline 337 \end{array}$$

51.
$$\begin{array}{r} {\scriptstyle 10} \\ 6\not{0}12 \\ 1\not{7}\not{1}\not{2} \\ -\ \ 289 \\ \hline 1423 \end{array}$$

53.
$$\begin{array}{r} {\scriptstyle 16\ 9} \\ 0\ 6\ 10\ 12 \\ \not{1}\not{7}\not{0}\not{2} \\ -\ 948 \\ \hline 754 \end{array}$$

55.
$$\begin{array}{r} {\scriptstyle 12} \\ 8\not{2}\ 13 \\ 5\not{9}\not{3}\not{3} \\ -\ 3754 \\ \hline 2179 \end{array}$$

57.
$$\begin{array}{r} {\scriptstyle 13\ 9} \\ 8\not{3}\not{1}0\ 17 \\ \not{9}\not{4}\not{0}\not{7} \\ -\ 2918 \\ \hline 6489 \end{array}$$

59.
$$\begin{array}{r} {\scriptstyle 15\ 9} \\ 7\not{5}\not{1}015 \\ \not{8}\not{6}\not{0}\not{5} \\ -7716 \\ \hline 889 \end{array}$$

61.
$$\begin{array}{r} {\scriptstyle \ \ \ 9} \\ 7\ 10\ 2\not{1}015 \\ \not{8}\not{0},\not{3}\not{0}\not{5} \\ -\ 9{,}176 \\ \hline 71{,}129 \end{array}$$

63.
$$\begin{array}{r} {\scriptstyle 9\ 9\ \ 9} \\ 0\ 10\not{1}0\not{2}014 \\ \not{1}\not{0},\not{0}\not{0}\not{4} \\ -\ 9{,}306 \\ \hline 698 \end{array}$$

65.
$$\begin{array}{r} {\scriptstyle 6\ 10} \\ \not{7}\not{0},618 \\ -41{,}213 \\ \hline 29{,}405 \end{array}$$

67.
$$\begin{array}{r} {\scriptstyle 6\ 10\ 6\ \overset{9}{10}\ 10} \\ 70{,}700 \\ -21{,}076 \\ \hline 49{,}624 \end{array}$$

69.
$$\begin{array}{r} {\scriptstyle 1\ \overset{15}{5}\ \overset{9}{10}\ 10} \\ 2600 \\ -1972 \\ \hline 628 \end{array}$$

71.
$$\begin{array}{r} {\scriptstyle 8\ \overset{9}{10}\ 10} \\ 9003 \\ -2471 \\ \hline 6532 \end{array}$$

73.
$$\begin{array}{r} {\scriptstyle 7\ \overset{11}{1}\ \overset{9}{10}\ 12} \\ 8202 \\ -3916 \\ \hline 4286 \end{array}$$

75.
$$\begin{array}{r} {\scriptstyle 6\ \overset{9}{10}\ 11} \\ 7015 \\ -2973 \\ \hline 4042 \end{array}$$

77.
$$\begin{array}{r} {\scriptstyle 6\ \overset{9}{10}\ \overset{9}{10}\ 15} \\ 7005 \\ -1796 \\ \hline 5209 \end{array}$$

79.
$$\begin{array}{r} {\scriptstyle 1\ \overset{9}{10}\ \overset{9}{10}\ \overset{9}{10}\ 15} \\ 20{,}005 \\ -\ 9{,}627 \\ \hline 10{,}378 \end{array}$$

81. (ii) and (iii)

83.
$$\begin{array}{r} {\scriptstyle 6\ 9\ 12\ 11} \\ 17{,}031 \\ -5792 \\ \hline 11{,}239 \end{array}$$

85.
$$\begin{array}{r} {\scriptstyle 7\ 17} \\ 29{,}874 \\ -21{,}392 \\ \hline 8482 \end{array}$$

87.
$$\begin{array}{r} {\scriptstyle 6\ 9\ 9\ 9\ 14} \\ 70{,}004 \\ -69{,}379 \\ \hline 625 \end{array}$$

89.
$$\begin{array}{r} {\scriptstyle 7\ 15\ 16\ 9\ 11} \\ 86{,}701 \\ -9{,}976 \\ \hline 76{,}725 \end{array}$$

91. Strategy To find the amount that completes the statement, subtract the addend (67) from the sum (90).

Solution
$$\begin{array}{r} 90 \\ -67 \\ \hline 23 \end{array}$$

Therefore 23 completes the statement, 67 + 23 = 90.

93. Strategy To find the amount that completes the statement, subtract the addend (253) from the sum (4901).

Solution
$$\begin{array}{r} 4901 \\ -\ 253 \\ \hline 4648 \end{array}$$

Therefore 4648 completes the statement, 253 + 4648 = 4901.

95.
$$\begin{array}{rrcrr} & 90{,}765 & \approx & & 90{,}000 \\ & -60{,}928 & \approx & & -60{,}000 \\ \hline \text{Cal.:} & 29{,}837 & & \text{Est.:} & 30{,}000 \end{array}$$

97.
$$\begin{array}{rrcrr} & 96{,}430 & \approx & & 100{,}000 \\ & -59{,}762 & \approx & & -60{,}000 \\ \hline \text{Cal.:} & 36{,}668 & & \text{Est.:} & 40{,}000 \end{array}$$

99.
$$\begin{array}{rrcrr} & 300{,}712 & \approx & & 300{,}000 \\ & -198{,}714 & \approx & & -200{,}000 \\ \hline \text{Cal.:} & 101{,}998 & & \text{Est.:} & 100{,}000 \end{array}$$

Objective C Exercises

101a. **Strategy** To find the difference, subtract the number of smell genes for the mosquito (79) from the number of smell genes for the honey bee (170)

Solution
$$\begin{array}{r} 170 \\ -\,79 \\ \hline 91 \end{array}$$

The honey bee has 91 more smell genes than the mosquito.

b. **Strategy** To find the difference, subtract the number of taste genes for the fruit fly (68) from the number of taste genes for the mosquito (76).

Solution
$$\begin{array}{r} 76 \\ -\,68 \\ \hline 8 \end{array}$$

The mosquito has 8 more taste genes than the fruit fly.

c. **Strategy** The insect with the best sense of smell has the most smell genes. Inspect the table to find the insect with the most smell genes.

Solution The honey bee has the most smell genes, so the honey bee has the best sense of smell.

d. **Strategy** The insect with the worst sense of taste has the fewest taste genes. Inspect the table to find the insect with the fewest taste genes.

Solution The honey bee has the fewest taste genes, so the honey bee has the worst sense of taste.

103. **Strategy** To find the difference in maximum heights between the two geysers, subtract the height of the Valentine (75 feet) from the height of the Great Fountain (90 feet).

Solution
$$\begin{array}{r} 90 \\ -\,75 \\ \hline 15 \end{array}$$

The Great Fountain geyser erupts 15 feet higher than the Valentine geyser.

105. **Strategy** To find how many more women than men earned a bachelor's degree, subtract the number of men (573,079) who earned a degree from the number of women (775,424) who earned a degree.

Solution
$$\begin{array}{r} 775{,}424 \\ -\,573{,}079 \\ \hline 202{,}345 \end{array}$$

202,345 more women than men earned a bachelor's degree in that year.

107a. **Strategy** To find which 2-year period has the smallest expected increase, find the difference for each of the 2-year periods and determine which is the smallest

difference.

Solution For 2010 – 2012:

$$\begin{array}{r} 146{,}000 \\ -129{,}000 \\ \hline 17{,}000 \end{array}$$

For 2012 – 2014:

$$\begin{array}{r} 166{,}000 \\ -146{,}000 \\ \hline 20{,}000 \end{array}$$

For 2014 – 2016:

$$\begin{array}{r} 187{,}000 \\ -166{,}000 \\ \hline 21{,}000 \end{array}$$

For 2016 – 2018:

$$\begin{array}{r} 208{,}000 \\ -187{,}000 \\ \hline 21{,}000 \end{array}$$

For 2018 – 2020:

$$\begin{array}{r} 235{,}000 \\ -208{,}000 \\ \hline 27{,}000 \end{array}$$

The smallest expected 2-year increase is 17,000 for 2010–2012.

b. Strategy To find which 2-year period has the greatest increase, find the difference for each of the 2-year periods and determine which is the greatest difference.

Solution Using the calculations from 107a, the greatest expected 2-year increase is 27,000 for 2018–2020.

109. Strategy To find your new credit card balance:

- Add to find the total of your purchases.
- Add the total amount of your purchases to the balance before the purchase ($409).
- Subtract your payment ($350) from the new balance.

Solution

$$\begin{array}{r} 168 \\ 36 \\ +\ 97 \\ \hline 301 \end{array}$$

$409 + 301 = 710$

$710 - 350 = 360$

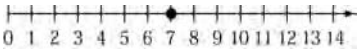
The new credit card balance is $360.

Critical Thinking

111. Answers will vary. For example:

Pat has earned 15 college credits, and Leslie has earned 8 college credits. How many more college credits has Pat earned? 7 college credits.

Check Your Progress: Chapter 1

1. 

2. $107 > 97$

3. Eighty-two thousand seven hundred forty-three

4. Two million five hundred thirty thousand twenty-one

5. 23,401

6. 903,003

7. 60,000 + 3000 + 200 + 90 + 1

8. 592,000

9. 46,000

10.
$$\begin{array}{r} 90,361 \\ 2955 \\ +\ 750,679 \\ \hline 843,995 \end{array}$$

11.
$$\begin{array}{r} 2034 \\ +\ 12,598 \\ \hline 14,632 \end{array}$$

12.
$$\begin{array}{r} 40,781 \\ +\ 156,742 \\ \hline 197,523 \end{array}$$

13.
$$\begin{array}{r} {\scriptstyle 1\ \ 9\ \ 13\ \ 15} \\ 1\not{2},\not{0}\not{4}\not{5} \\ -\ 4\ 9\ 8\ 7 \\ \hline 7\ 0\ 5\ 8 \end{array}$$

14.
$$\begin{array}{r} {\scriptstyle 8\ 13\ 5\ 11} \\ \not{9}\not{3}\not{6}\not{1} \\ -\ \ 8\ 2\ 3 \\ \hline 8\ 5\ 3\ 8 \end{array}$$

15. $14,800,000,000,000

16. **Strategy** To find the difference in heights between the two waterfalls, subtract the height of Yosemite Falls (2425 feet) from the height of Colonial Falls (2585 feet).

Solution
$$\begin{array}{r} 2585 \\ -2425 \\ \hline 160 \end{array}$$

Colonial Falls is 160 feet higher than Yosemite Falls.

17. **Strategy** To find the total amount of Janice's contribution, add the six amounts.

Solution
$$\begin{array}{r} 25 \\ 30 \\ 13 \\ 15 \\ 20 \\ +\ 27 \\ \hline 130 \end{array}$$

The total amount of Janice's contributions is $130.

18. **Strategy** To find the amount boys grow from birth to age 5, subtract the median height for boys at birth (50 cm) from the median height for boys at age 5 (110 cm).

Solution
$$\begin{array}{r} 110 \\ -\ 50 \\ \hline 60 \end{array}$$

Boys grow 60 cm from birth to age 5.

19. **Strategy** To find the two years between which girls grow the most, find the difference in median heights for girls for each of the years and determine which is the greatest difference.

Solution For Birth – 1 year:
$$\begin{array}{r} 74 \\ -\ 49 \\ \hline 25 \end{array}$$

For 1 year – 2 years:
$$\begin{array}{r} 84 \\ -\ 74 \\ \hline 10 \end{array}$$

For 2 years – 3 years:

$$\begin{array}{r} 95 \\ -\ 84 \\ \hline 11 \end{array}$$

For 3 years – 4 years:

$$\begin{array}{r} 100 \\ -\ 95 \\ \hline 5 \end{array}$$

For 4 years – 5 years:

$$\begin{array}{r} 108 \\ -\ 100 \\ \hline 8 \end{array}$$

The greatest difference is 25 cm, between birth and age 1.

20. **Strategy** To find the golfer's total score for the four rounds, add the scores for each round (68, 72, 69, and 66).

Solution

$$\begin{array}{r} 68 \\ 72 \\ 69 \\ +\ 66 \\ \hline 275 \end{array}$$

The golfer's total score was 275.

Section 1.4

Concept Check

1. 6×2 or $6 \cdot 2$

3. 4×7 or $4 \cdot 7$

5. Multiplication Property of One

7. Commutative Property of Multiplication

Objective A Exercises

9. 12

11. 35

13. 25

15. 0

17. 72

19.
$$\begin{array}{r} {\scriptstyle 1} \\ 66 \\ \times\ 3 \\ \hline 198 \end{array}$$

21.
$$\begin{array}{r} {\scriptstyle 3} \\ 67 \\ \times\ 5 \\ \hline 335 \end{array}$$

23.
$$\begin{array}{r} {\scriptstyle 1} \\ 623 \\ \times\ 4 \\ \hline 2492 \end{array}$$

25.
$$\begin{array}{r} {\scriptstyle 6} \\ 607 \\ \times\ 9 \\ \hline 5463 \end{array}$$

27.
$$\begin{array}{r} 600 \\ \times\ 7 \\ \hline 4200 \end{array}$$

29.
$$\begin{array}{r} {\scriptstyle 2} \\ 703 \\ \times\ 9 \\ \hline 6327 \end{array}$$

31.
$$\begin{array}{r} 632 \\ \times\ 3 \\ \hline 1896 \end{array}$$

33.
$$\begin{array}{r} {\scriptstyle 2\,1} \\ 632 \\ \times\ 8 \\ \hline 5056 \end{array}$$

35.
$$\begin{array}{r} {\scriptstyle 1\,3} \\ 337 \\ \times\ 5 \\ \hline 1685 \end{array}$$

37.
$$\begin{array}{r} {\scriptstyle 4\ \ 6} \\ 6709 \\ \times\ 7 \\ \hline 46,963 \end{array}$$

39.
$$\begin{array}{r} {\scriptstyle 3\,4\,5} \\ 8568 \\ \times \quad 7 \\ \hline 59{,}976 \end{array}$$

41.
$$\begin{array}{r} {\scriptstyle 3\,3} \\ 4780 \\ \times \quad 4 \\ \hline 19{,}120 \end{array}$$

43.
$$\begin{array}{r} {\scriptstyle 1\,1\,1} \\ 9895 \\ \times \quad 2 \\ \hline 19{,}790 \end{array}$$

45. $5 \times 7 \times 4 = 140$

47.
$$\begin{array}{r} 3208 \\ \times \quad 7 \\ \hline 22{,}456 \end{array}$$

49.
$$\begin{array}{r} 3105 \\ \times \quad 6 \\ \hline 18{,}630 \end{array}$$

Objective B Exercises

51.
$$\begin{array}{r} 16 \\ \times\ 21 \\ \hline 16 \\ 32 \\ \hline 336 \end{array}$$

53.
$$\begin{array}{r} 35 \\ \times\ 26 \\ \hline 210 \\ 70 \\ \hline 910 \end{array}$$

55.
$$\begin{array}{r} 693 \\ \times\ 91 \\ \hline 693 \\ 6237 \\ \hline 63{,}063 \end{array}$$

57.
$$\begin{array}{r} 419 \\ \times \quad 80 \\ \hline 33{,}520 \end{array}$$

59.
$$\begin{array}{r} 8279 \\ \times \quad 46 \\ \hline 49674 \\ 33116 \\ \hline 380{,}834 \end{array}$$

61.
$$\begin{array}{r} 6938 \\ \times \quad 78 \\ \hline 55504 \\ 48566 \\ \hline 541{,}164 \end{array}$$

63.
$$\begin{array}{r} 7035 \\ \times \quad 57 \\ \hline 49245 \\ 35175 \\ \hline 400{,}995 \end{array}$$

65.
$$\begin{array}{r} 3009 \\ \times \quad 35 \\ \hline 15045 \\ 9027 \\ \hline 105{,}315 \end{array}$$

67.
$$\begin{array}{r} 809 \\ \times \quad 530 \\ \hline 24270 \\ 4045 \\ \hline 428{,}770 \end{array}$$

69.
$$\begin{array}{r} 800 \\ \times \quad 325 \\ \hline 4000 \\ 1600 \\ 2400 \\ \hline 260{,}000 \end{array}$$

71.
$$\begin{array}{r} 987 \\ \times\ 349 \\ \hline 8883 \\ 3948 \\ 2961 \\ \hline 344{,}463 \end{array}$$

73.
$$\begin{array}{r} 312 \\ \times\ 134 \\ \hline 1248 \\ 936 \\ 312 \\ \hline 41{,}808 \end{array}$$

75.
$$\begin{array}{r} 379 \\ \times\ 500 \\ \hline 189{,}500 \end{array}$$

77.
$$\begin{array}{r} 985 \\ \times\ 408 \\ \hline 7880 \\ 39400 \\ \hline 401{,}880 \end{array}$$

79.
$$\begin{array}{r} 3407 \\ \times\ 309 \\ \hline 30663 \\ 102210 \\ \hline 1{,}052{,}763 \end{array}$$

81.
$$\begin{array}{r} 4258 \\ \times\ 986 \\ \hline 25548 \\ 34064 \\ 38322 \\ \hline 4{,}198{,}388 \end{array}$$

83. Answers will vary. For example, 5 and 20

$$\begin{array}{r} 20 \\ \times 5 \\ \hline 100 \end{array}$$

85.
$$\begin{array}{r} 7349 \\ \times\ 27 \\ \hline 51443 \\ 14698 \\ \hline 198{,}423 \end{array}$$

87. $6 \times 73 = 438$

$$\begin{array}{r} 438 \\ \times\ 43 \\ \hline 1314 \\ 1752 \\ \hline 18{,}834 \end{array}$$

89.
$$\begin{array}{r} 842 \\ \times\ 309 \\ \hline 7578 \\ 2526 \\ \hline 260{,}178 \end{array}$$

91.
$$\begin{array}{rcr} 4732 & \approx & 5000 \\ \times\ 93 & \approx & \times\ 90 \end{array}$$
Cal.: 440,076 Est.: 450,000

93.
$$\begin{array}{rcr} 8941 & \approx & 9000 \\ \times\ 726 & \approx & \times\ 700 \end{array}$$
Cal.: 6,491,166 Est.: 6,300,000

95.
$$\begin{array}{rcr} 6379 & \approx & 6000 \\ \times\ 2936 & \approx & \times\ 3000 \end{array}$$
Cal.: 18,728,744 Est.: 18,000,000

97.
$$\begin{array}{rcr} 62{,}504 & \approx & 60{,}000 \\ \times\ 923 & \approx & \times\ 900 \end{array}$$
Cal.: 57,691,192 Est.: 54,000,000

Objective C Exercises

99. **Strategy** To find the area, multiply the length (78 ft) by the width (36 ft).

Solution
$$\begin{array}{r} 78 \\ \times 36 \\ \hline 468 \\ 234 \\ \hline 2808 \end{array}$$

The area is 2808 square feet.

101. **Strategy** To find the distance the car could travel on 12 gallons of gas, multiply the mileage per gallon (43) by the number of gallons (12).

Solution
$$\begin{array}{r} 43 \\ \times 12 \\ \hline 86 \\ 43 \\ \hline 516 \end{array}$$

The car could travel 516 miles.

103a. **Strategy** To find the number of marriages per week, multiply the number per day (542) by the number of days in a week (7).

Solution

$$\begin{array}{r} 542 \\ \times \quad 7 \\ \hline 3794 \end{array}$$

3794 marriages occur each week between eHarmony members.

b. **Strategy** To find the number of marriages per year, multiply the number per day (542) by the number of days in a year (365).

Solution

$$\begin{array}{r} 365 \\ \times 542 \\ \hline 730 \\ 14\,60 \\ 182\,5 \\ \hline 197{,}830 \end{array}$$

197,830 marriages occur each year between eHarmony members.

105. **Strategy** To estimate the cost for the electricians' labor, multiply the number of electricians (3) by the number of hours each works (50) by the wage per hour (34).

Solution

Total cost
= no. of electricians
× no. hours each works
× wages per hour
$= 3 \times 50 \times 34$
$= 5100$

The estimated cost of the electricians' labor is \$5100.

107. **Strategy** To find the total cost for the four components:

- Determine the costs for the electrician, the plumber, the clerical work, and the bookkeeper.
- Add to find the sum of the four costs.

Solution

$$\begin{aligned} \textit{Electrician} &= 1 \times 30 \times \$34 = \$1020 \\ \textit{Plumber} &= 1 \times 33 \times \$30 = \$990 \\ \textit{Clerk} &= 1 \times 3 \times \$16 = \$48 \\ \textit{Bookkeeper} &= 1 \times 4 \times \$20 = \$80 \\ \textit{Total} &= \$2138 \end{aligned}$$

The total cost is \$2138.

Critical Thinking

109. There is one accidental death every 5 minutes.

There are 60 minutes in an hour.

$5 \times 12 = 60$

There are 12 accidental deaths in an hour.

There are 24 hours per day.

$12 \times 24 = 288$

There are 288 accidental deaths in a day.

There are 365 days in a year.

$288 \times 365 = 105{,}120$

There are 105,120 accidental deaths in a year.

Projects or Group Activities

111. S = 2, T = 1, R = 9, A = 7, W = 8

$$\begin{array}{r} 21{,}978 \\ \times \quad 4 \\ \hline 87{,}912 \end{array}$$

Section 1.5

Concept Check

1. 2: $2 \times 4 = 8$

3. 6; $6 \times 5 = 30$

5. 6

7. 12

Objective A Exercises

9. 7

11.
$$\begin{array}{r} 16 \\ 6\overline{)96} \\ -\,6 \\ \hline 36 \\ -\,36 \\ \hline 0 \end{array}$$

13.
$$\begin{array}{r} 210 \\ 4\overline{)840} \\ -8 \\ \hline 04 \\ -\,4 \\ \hline 00 \\ -\,0 \\ \hline 0 \end{array}$$

15.
$$\begin{array}{r} 44 \\ 7\overline{)308} \\ -\,28 \\ \hline 28 \\ -\,28 \\ \hline 0 \end{array}$$

17.
$$\begin{array}{r} 703 \\ 9\overline{)6327} \\ -\,63 \\ \hline 02 \\ -\,0 \\ \hline 27 \\ -27 \\ \hline 0 \end{array}$$

19.
$$\begin{array}{r} 910 \\ 8\overline{)7280} \\ \underline{-72} \\ 08 \\ \underline{-\ 8} \\ 00 \\ \underline{-\ 0} \\ 0 \end{array}$$

21.
$$\begin{array}{r} 5006 \\ 7\overline{)35{,}042} \\ \underline{-35} \\ 0\ 042 \\ \underline{-42} \\ 0 \end{array}$$

23.
$$\begin{array}{r} 6050 \\ 9\overline{)54{,}450} \\ \underline{-54} \\ 0\ 45 \\ \underline{-45} \\ 00 \end{array}$$

25.
$$\begin{array}{r} 1075 \\ 7\overline{)7525} \\ \underline{-\ 7} \\ 05 \\ \underline{-\ 0} \\ 52 \\ \underline{-\ 49} \\ 35 \\ \underline{-35} \\ 0 \end{array}$$

27. 1

Objective B Exercises

29.
$$\begin{array}{r} 3 \text{ r1} \\ 2\overline{)7} \\ \underline{-6} \\ 1 \end{array}$$

31.
$$\begin{array}{r} 9 \text{ r7} \\ 9\overline{)88} \\ \underline{-81} \\ 7 \end{array}$$

33.
$$\begin{array}{r} 16 \text{ r1} \\ 6\overline{)97} \\ \underline{-6} \\ 37 \\ \underline{-36} \\ 1 \end{array}$$

35.
$$\begin{array}{r} 10 \text{ r4} \\ 5\overline{)54} \\ \underline{-5} \\ 04 \\ \underline{-\ 0} \\ 4 \end{array}$$

37.
$$\begin{array}{r} 90 \text{ r3} \\ 4\overline{)363} \\ \underline{-36} \\ 03 \\ \underline{-\ 0} \\ 3 \end{array}$$

39.
$$\begin{array}{r} 120 \text{ r5} \\ 7\overline{)845} \\ \underline{-7} \\ 14 \\ \underline{-14} \\ 05 \\ \underline{-\ 0} \\ 5 \end{array}$$

41.
$$\begin{array}{r} 309 \text{ r3} \\ 5\overline{)1548} \\ \underline{-15} \\ 04 \\ \underline{-\ 0} \\ 48 \\ \underline{-45} \\ 3 \end{array}$$

43.
$$\begin{array}{r} 1160 \text{ r4} \\ 7\overline{)8124} \\ \underline{-7} \\ 11 \\ \underline{-7} \\ 42 \\ \underline{-42} \\ 04 \\ \underline{-\ 0} \\ 4 \end{array}$$

45.
$$\begin{array}{r} 708 \text{ r2} \\ 5\overline{)3542} \\ -35 \\ \hline 04 \\ -0 \\ \hline 42 \\ -40 \\ \hline 2 \end{array}$$

47.
$$\begin{array}{r} 3\,825 \text{ r1} \\ 4\overline{)15,301} \\ -12 \\ \hline 33 \\ -32 \\ \hline 10 \\ -8 \\ \hline 21 \\ -20 \\ \hline 1 \end{array}$$

49.
$$\begin{array}{r} 5\,710 \text{ r3} \\ 6\overline{)34,263} \\ -30 \\ \hline 42 \\ -42 \\ \hline 06 \\ -6 \\ \hline 03 \\ -0 \\ \hline 3 \end{array}$$

51.
$$\begin{array}{r} 11,434 \text{ r2} \\ 4\overline{)45,738} \\ -4 \\ \hline 05 \\ -4 \\ \hline 17 \\ -16 \\ \hline 13 \\ -12 \\ \hline 18 \\ -16 \\ \hline 2 \end{array}$$

Round to 11,430.

53.
$$\begin{array}{r} 510 \text{ r2} \\ 7\overline{)3572} \\ -35 \\ \hline 07 \\ -7 \\ \hline 02 \\ -0 \\ \hline 2 \end{array}$$

Round to 510.

55. False

Objective C Exercises

57.
$$\begin{array}{r} 1 \text{ r38} \\ 44\overline{)82} \\ -44 \\ \hline 38 \end{array}$$

59.
$$\begin{array}{r} 1 \text{ r26} \\ 67\overline{)93} \\ -67 \\ \hline 26 \end{array}$$

61.
$$\begin{array}{r} 21 \text{ r21} \\ 32\overline{)693} \\ -64 \\ \hline 53 \\ -32 \\ \hline 21 \end{array}$$

63.
$$\begin{array}{r} 30 \text{ r22} \\ 25\overline{)772} \\ -75 \\ \hline 22 \\ -0 \\ \hline 22 \end{array}$$

65.
$$\begin{array}{r} 5 \text{ r40} \\ 92\overline{)500} \\ -460 \\ \hline 40 \end{array}$$

67.
$$\begin{array}{r} 9 \text{ r17} \\ 50\overline{)467} \\ -450 \\ \hline 17 \end{array}$$

69.
$$\begin{array}{r} 200 \text{ r21} \\ 44\overline{)8821} \\ -88 \\ \hline 02 \\ -0 \\ \hline 21 \\ -0 \\ \hline 21 \end{array}$$

71.
$$\begin{array}{r} 303 \text{ r1} \\ 32\overline{)9697} \\ -96 \\ \hline 09 \\ -\ 0 \\ \hline 97 \\ -96 \\ \hline 1 \end{array}$$

73.
$$\begin{array}{r} 67 \text{ r13} \\ 92\overline{)6177} \\ -552 \\ \hline 657 \\ -644 \\ \hline 13 \end{array}$$

75.
$$\begin{array}{r} 708 \text{ r49} \\ 63\overline{)44,653} \\ -44\,1 \\ \hline 553 \\ -504 \\ \hline 49 \end{array}$$

77.
$$\begin{array}{r} 1\,086 \text{ r7} \\ 77\overline{)83,639} \\ -77 \\ \hline 66 \\ -\ 0 \\ \hline 662 \\ -616 \\ \hline 469 \\ -462 \\ \hline 7 \end{array}$$

79.
$$\begin{array}{r} 5007 \text{ r55} \\ 73\overline{)365,566} \\ -365 \\ \hline 0566 \\ -511 \\ \hline 55 \end{array}$$

81.
$$\begin{array}{r} 12 \text{ r456} \\ 504\overline{)6504} \\ -504 \\ \hline 1464 \\ -1008 \\ \hline 456 \end{array}$$

83.
$$\begin{array}{r} 4 \text{ r160} \\ 546\overline{)2344} \\ -\ 2184 \\ \hline 160 \end{array}$$

85.
$$\begin{array}{r} 160 \text{ r27} \\ 53\overline{)8507} \\ -\ 53 \\ \hline 320 \\ -\ 318 \\ \hline 27 \end{array}$$

87.
$$\begin{array}{r} 1\,669 \text{ r14} \\ 46\overline{)76,788} \\ -46 \\ \hline 307 \\ -276 \\ \hline 318 \\ -\ 276 \\ \hline 428 \\ -414 \\ \hline 14 \end{array}$$

89.
$$\begin{array}{r} 7\,948 \text{ r17} \\ 43\overline{)341,781} \\ -301 \\ \hline 407 \\ -387 \\ \hline 208 \\ -172 \\ \hline 361 \\ -344 \\ \hline 17 \end{array}$$

Round to 7950.

91. Cal.: $76\overline{)389,804}$ $\quad 5129$ Est.: $80\overline{)400,000}$ $\quad 5000$

93. Cal.: $29\overline{)637,072}$ $\quad 21{,}968$ Est.: $30\overline{)600,000}$ $\quad 20{,}000$

95. Cal.: $38\overline{)934,684}$ $\quad 24{,}596$ Est.: $40\overline{)900,000}$ $\quad 22{,}500$

97. Cal.: $309\overline{)876,324}$ $\quad 2836$ Est.: $300\overline{)900,000}$ $\quad 3000$

99. Cal.: $209\overline{)632,016}$ $\quad 3024$ Est.: $200\overline{)600,000}$ $\quad 3000$

101. Cal.: $179\overline{)5,734,444}$ $\quad 32{,}036$ Est.: $200\overline{)6{,}000{,}000}$ $\quad 30{,}000$

Objective D Exercises

103. **Strategy** To find the monthly salary, divide the annual salary ($69,048) by the number of months (12).

Solution

$$\begin{array}{r} 5754 \\ 12\overline{)69,048} \\ -60 \\ \hline 90 \\ -84 \\ \hline 64 \\ -60 \\ \hline 48 \\ -48 \\ \hline 0 \end{array}$$

Melissa's monthly salary is $5754.

105. **Strategy** To find the cost of the gold alloy in each necklace:

- Find the total cost of the gold alloy by multiplying the number of ounces of gold (30) by the price per ounce ($375).
- Divide the total cost of the gold alloy by the number of necklaces (15).

Solution

$$\begin{array}{r} 375 \\ \times\ 30 \\ \hline 11,250 \end{array} \qquad \begin{array}{r} 750 \\ 15\overline{)11,250} \\ -105 \\ \hline 75 \\ -75 \\ \hline 00 \\ -0 \\ \hline 0 \end{array}$$

The gold alloy in each necklace costs $750.

107. **Strategy** To find the average score:

- Add the scores for the four exams (86, 94, 79, and 93).
- Divide the sum by the number of exams (4).

Solution

$$\begin{array}{r} 86 \\ 94 \\ 79 \\ +\ 93 \\ \hline 352 \end{array} \qquad \begin{array}{r} 88 \\ 4\overline{)352} \\ -32 \\ \hline 32 \\ -32 \\ \hline 0 \end{array}$$

The average score was 88.

109. **Strategy** To find the monthly payment:

- Subtract the down payment ($1620) from the cost of the television ($3180).
- Divide the result by the number of monthly payments (12).

Solution

$$\begin{array}{r} 3180 \\ -1620 \\ \hline 1560 \end{array} \qquad \begin{array}{r} 130 \\ 12\overline{)1560} \\ -12 \\ \hline 36 \\ -36 \\ \hline 00 \\ -0 \\ \hline 0 \end{array}$$

The monthly payment is $130.

111. **Strategy** To find the average monthly claim for theft, divide the annual claim for theft ($300,000) by the

number of months (12).

Solution

$$\begin{array}{r} 25{,}000 \\ 12\overline{)300{,}000} \\ \underline{-24} \\ 60 \\ \underline{-60} \\ 00 \\ \underline{-\ 0} \\ 00 \\ \underline{-\ 0} \\ 00 \\ \underline{-\ 0} \\ 0 \end{array}$$

The average monthly claim for theft is $25,000.

113. Strategy To find the average hours worked by employees in the United Kingdom, divide the annual hours worked (1731) by the number of weeks (50).

Solution

$$\begin{array}{r} 32 \\ 50\overline{)1646} \\ \underline{-150} \\ 146 \\ \underline{-100} \\ 46 \end{array}$$

Since 46 is greater than half of 50, the average number of hours worked by employees in the United Kingdom is 33 hours.

115. Strategy To find the difference per week:

- Read the table to determine the greatest number of hours worked per year.
- Read the table to find the least number of hours worked per year.
- Subtract the least number from the greatest number.
- Divide the result by the number of weeks worked per year (50).

Solution Greatest number of hours worked: 2119 (Greece)

Least number of hours worked: 1390 (Germany)

$$\begin{array}{r} 2119 \\ \underline{-1390} \\ 729 \end{array} \qquad \begin{array}{r} 14 \\ 50\overline{)729} \\ \underline{-50} \\ 229 \\ \underline{-200} \\ 29 \end{array}$$

On average, employees in Greece work 15 more hours per week than employees in Germany.

117. Strategy To find the number of pieces processed per day, divide the total number of pieces of mail processed (117 billion, or 117,000,000,000) by the number of working days in a year (300).

Solution

$$\begin{array}{r} 390{,}000{,}000 \\ 300\overline{)117{,}000{,}000{,}000} \\ \underline{-900} \\ 2700 \\ \underline{-2700} \\ 0 \end{array}$$

The U.S. Postal Service processed 390 million pieces of mail.

Critical Thinking

119. **Strategy** To find the total of the three deductions, add the three deductions.

Solution

$$\begin{array}{rl} \$225 & \text{Savings} \\ 98 & \text{Taxes} \\ 27 & \text{Insurance} \\ \hline \$350 & \end{array}$$

The total of the three deductions is $350.

121. **Strategy** To find how many more cases of eggs were sold by retail stores than were used for non-shell products, subtract the number of non-shell products cases (61,600,000) from the number of cases sold in retail stores (111,100,000).

Solution

$$\begin{array}{r} 111{,}100{,}000 \\ -\,61{,}600{,}000 \\ \hline 49{,}500{,}000 \end{array}$$

Retail stores sold 49,500,000 more cases of eggs than were used for nonshell products.

123. **Strategy** To find the monthly expense for housing, divide annual housing expense ($11,713)by the number of months(12).

Solution

$$\begin{array}{r} 976 \\ 12\overline{)11{,}713} \\ -108 \\ \hline 91 \\ -84 \\ \hline 73 \\ -72 \\ \hline 1 \end{array}$$

The average monthly expense for housing is $976.

125. **Strategy** To find the total amount paid for the car:

- Multiply $195 by 48 to find the amount paid in monthly payments.
- Add the total for the monthly payments to the down payment ($2500).

Solution

$$\begin{array}{r} 195 \\ \times\ 48 \\ \hline 1560 \\ 780 \\ \hline 9360 \end{array} \qquad \begin{array}{r} 2500 \\ +9360 \\ \hline 11{,}860 \end{array}$$

The total amount paid for the car was $11,860.

Projects or Group Activities

127. Subtraction

129. Division

Section 1.6

Concept Check

1. Five times

3. (i) and (iii)

Objective A Exercises

5. 2^3

7. $6^3 \cdot 7^4$

9. $2^3 \cdot 3^3$

11. $5 \cdot 7^5$

13. $3^3 \cdot 6^4$

15. $3^3 \cdot 5 \cdot 9^3$

17. $2 \cdot 2 \cdot 2 = 8$

19. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 = 16 \cdot 25 = 400$

21. $3 \cdot 3 \cdot 10 \cdot 10 = 9 \cdot 100 = 900$

23. $6 \cdot 6 \cdot 3 \cdot 3 \cdot 3 = 36 \cdot 27 = 972$

25. $5 \cdot 2 \cdot 2 \cdot 2 \cdot 3 = 5 \cdot 8 \cdot 3 = 120$

27. $2 \cdot 2 \cdot 3 \cdot 3 \cdot 10 = 4 \cdot 9 \cdot 10 = 360$

29. $0 \cdot 0 \cdot 4 \cdot 4 \cdot 4 = 0 \cdot 64 = 0$

31. $3 \cdot 3 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 9 \cdot 10{,}000 = 90{,}000$

33. $2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5 = 4 \cdot 27 \cdot 5 = 540$

35. $2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 5 \cdot 5 = 2 \cdot 81 \cdot 25 = 4050$

37. $5 \cdot 5 \cdot 3 \cdot 3 \cdot 7 \cdot 7 = 25 \cdot 9 \cdot 49 = 11{,}025$

39. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5$
$= 81 \cdot 64 \cdot 5$
$= 25{,}920$

41. $4 \cdot 4 \cdot 3 \cdot 3 \cdot 3 \cdot 10 \cdot 10 \cdot 10 \cdot 10$
$= 16 \cdot 27 \cdot 10{,}000$
$= 4{,}320{,}000$

Objective B Exercises

43. $4 - 2 + 3 = 2 + 3 = 5$

45. $6 \cdot 3 + 5 = 18 + 5 = 23$

47. $14 - 2 \cdot 4 = 14 - 8 = 6$

49. $3 + 6 \div 3 = 3 + 2 = 5$

51. $2 \cdot 3^2 = 2 \cdot 9 = 18$

53. $4 \cdot (5 - 3) + 2 = 4 \cdot 2 + 2 = 8 + 2 = 10$

55. $5 + (8 + 4) \div 6 = 5 + 12 \div 6$
$= 5 + 2 = 7$

57. $16 \cdot (3 + 2) \div 10 = 16 \cdot 5 \div 10$
$= 80 \div 10 = 8$

59. $10 - 2^3 + 4 = 10 - 8 + 4$
$= 2 + 4 = 6$

61. $16 + 4 \cdot 3^2 = 16 + 4 \cdot 9$
$= 16 + 36 = 52$

63. $16 + (8 - 3) \cdot 2 = 16 + 5 \cdot 2$
$= 16 + 10 = 26$

65. $2^2 + 3 \cdot (6 - 2)^2 = 2^2 + 3 \cdot 4^2$
$= 4 + 3 \cdot 16$
$= 4 + 48 = 52$

67. $2^2 \cdot 3^2 + 2 \cdot 3 = 4 \cdot 9 + 2 \cdot 3$
$= 36 + 2 \cdot 3$
$= 36 + 6 = 42$

69. $3 \cdot (6 - 2) + 4 = 3 \cdot 4 + 4 = 12 + 4 = 16$

71. $8 - (8 - 2) \div 3 = 8 - 6 \div 3 = 8 - 2 = 6$

73. $8 + 2 - 3 \cdot 2 \div 3 = 8 + 2 - 6 \div 3$
$= 8 + 2 - 2$
$= 10 - 2 = 8$

75. $3 \cdot (4 + 2) \div 6 = 3 \cdot 6 \div 6 = 18 \div 6 = 3$

77. $20 - 4 \div 2 \cdot (3 - 1)^3 = 20 - 4 \div 2 \cdot 2^3$
$= 20 - 4 \div 2 \cdot 8$
$= 20 - 2 \cdot 8$
$= 20 - 16 = 4$

79. $(4 - 2) \cdot 6 \div 3 + (5 - 2)^2 = 2 \cdot 6 \div 3 + 3^2$
$= 2 \cdot 6 \div 3 + 9$
$= 12 \div 3 + 9$
$= 4 + 9 = 13$

81. $100 \div (2 + 3)^2 - 8 \div 2 = 100 \div 5^2 - 8 \div 2$
$= 100 \div 25 - 8 \div 2$
$= 4 - 8 \div 2$
$= 4 - 4 = 0$

83. $(2 \cdot 3 + 8) \cdot 4 - 2 = (6 + 8) \cdot 4 - 2$
$= 14 \cdot 4 - 2$
$= 56 - 2$
$= 54$

85. $2 \cdot (3 + 8 \cdot 4 - 2) = 2 \cdot (3 + 32 - 2)$
$= 2 \cdot (35 - 2)$
$= 2 \cdot 33$
$= 66$

Critical Thinking

87. $(2+3)^5 = 5^5 = 3125$

$2^5 + 3^5 = 32 + 243 = 275$

No, the expression are not equal.

89. $(6-4)^4 = 2^4 = 16$

$6^4 - 4^4 = 396 - 256 = 1040$

No, the expressions are not equal.

Projects or Group Activities

91a. $\left(3^4\right)^2 = 81^2 = 6561$

b. $3^{(4^2)} = 3^{16} = 43{,}046{,}721$

c. $3^{4^2} = 3^{16} = 43{,}046{,}721$

Section 1.7

Concept Check

1. (ii), (iii), (v), and (vi)

Objective A Exercises

3. $4 \div 1 = 4$

$4 \div 2 = 2$

Factors are 1, 2, and 4.

5. $10 \div 1 = 10$

$10 \div 2 = 5$

$10 \div 5 = 2$

Factors are 1, 2, 5, and 10.

7. $7 \div 1 = 7$

$7 \div 7 = 1$

Factors are 1 and 7.

9. $9 \div 1 = 9$

$9 \div 3 = 3$

Factors are 1, 3, and 9.

11. $13 \div 1 = 13$

$13 \div 13 = 1$

Factors are 1 and 13.

13. $18 \div 1 = 18$

$18 \div 2 = 9$

$18 \div 3 = 6$

$18 \div 6 = 3$

Factors are 1, 2, 3, 6, 9, and 18.

15. $56 \div 1 = 56$

$56 \div 2 = 28$

$56 \div 4 = 14$

$56 \div 7 = 8$

$56 \div 8 = 7$

Factors are 1, 2, 4, 7, 8, 14, 28, and 56.

17. $45 \div 1 = 45$

$45 \div 3 = 15$

$45 \div 5 = 9$

Factors are 1, 3, 5, 9, 15, and 45.

19. $29 \div 1 = 29$

$29 \div 29 = 1$

Factors are 1 and 29.

21. $22 \div 1 = 22$

$22 \div 2 = 11$

$22 \div 11 = 2$

Factors are 1, 2, 11, and 22.

23. $52 \div 1 = 52$

$52 \div 2 = 26$

$52 \div 4 = 13$

$52 \div 13 = 4$

Factors are 1, 2, 4, 13, 26, and 52.

25. $82 \div 1 = 82$

$82 \div 2 = 41$

$82 \div 41 = 2$

Factors are 1, 2, 41, and 82.

27. $57 \div 1 = 57$

$57 \div 3 = 19$

$57 \div 19 = 3$

Factors are 1, 3, 19, and 57.

29. $48 \div 1 = 48$
$48 \div 2 = 24$
$48 \div 3 = 16$
$48 \div 4 = 12$
$48 \div 6 = 8$
$48 \div 8 = 6$
Factors are 1, 2, 3, 4, 6, 8, 12, 16, 24, and 48.

31. $95 \div 1 = 95$
$95 \div 5 = 19$
$95 \div 19 = 5$
Factors are 1, 5, 19, and 95.

33. $54 \div 1 = 54$
$54 \div 2 = 27$
$54 \div 3 = 18$
$54 \div 6 = 9$
$54 \div 9 = 6$
Factors are 1, 2, 3, 6, 9, 18, 27, and 54.

35. $66 \div 1 = 66$
$66 \div 2 = 33$
$66 \div 3 = 22$
$66 \div 6 = 11$
$66 \div 11 = 6$
Factors are 1, 2, 3, 6, 11, 22, 33, and 66.

37. $80 \div 1 = 80$
$80 \div 2 = 40$
$80 \div 4 = 20$
$80 \div 5 = 16$
$80 \div 8 = 10$
$80 \div 10 = 8$
Factors are 1, 2, 4, 5, 8, 10, 16, 20, 40, and 80.

39. $96 \div 1 = 96$
$96 \div 2 = 48$
$96 \div 3 = 32$
$96 \div 4 = 24$
$96 \div 6 = 16$
$96 \div 8 = 12$
$96 \div 12 = 8$
Factors are 1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, and 96.

41. $90 \div 1 = 90$
$90 \div 2 = 45$
$90 \div 3 = 30$
$90 \div 5 = 18$
$90 \div 6 = 15$
$90 \div 9 = 10$
$90 \div 10 = 9$
Factors are 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, and 90.

43. True

Objective B Exercises

45.
$$\begin{array}{r|l} 2 & 6 \\ 3 & 3 \\ \hline & 1 \end{array}$$
$6 = 2 \cdot 3$

47. 17 is prime.

49.
$$\begin{array}{r|l} 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ 3 & 3 \\ \hline & 1 \end{array}$$
$24 = 2 \cdot 2 \cdot 2 \cdot 3$

51.
$$\begin{array}{r|l} 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ \hline & 1 \end{array}$$
$27 = 3 \cdot 3 \cdot 3$

53.
$$\begin{array}{r|l} 2 & 36 \\ 2 & 18 \\ 3 & 9 \\ 3 & 3 \\ \hline & 1 \end{array}$$
$36 = 2 \cdot 2 \cdot 3 \cdot 3$

55. 19 is prime.

57.
$$\begin{array}{r|l} 2 & 90 \\ 3 & 45 \\ 3 & 15 \\ 5 & 5 \\ \hline & 1 \end{array}$$
$90 = 2 \cdot 3 \cdot 3 \cdot 5$

59.
115
5 | 23
23 | 1
$115 = 5 \cdot 23$

61.
18
2 | 9
3 | 3
3 | 1
$18 = 2 \cdot 3 \cdot 3$

63.
28
2 | 14
2 | 7
7 | 1
$28 = 2 \cdot 2 \cdot 7$

65. 31 is prime.

67.
62
2 | 31
31 | 1
$62 = 2 \cdot 31$

69.
22
2 | 11
11 | 1
$22 = 2 \cdot 11$

71. 101 is prime.

73.
66
2 | 33
3 | 11
11 | 1
$66 = 2 \cdot 3 \cdot 11$

75.
74
2 | 37
37 | 1
$74 = 2 \cdot 37$

77. 67 is prime.

79.
55
5 | 11
11 | 1
$55 = 5 \cdot 11$

81.
120
2 | 60
2 | 30
2 | 15
3 | 5
5 | 1
$120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5$

83.
160
2 | 80
2 | 40
2 | 20
2 | 10
2 | 5
5 | 1
$160 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5$

85.
216
2 | 108
2 | 54
2 | 27
3 | 9
3 | 3
3 | 1
$216 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$

87.
625
5 | 125
5 | 25
5 | 5
5 | 1
$625 = 5 \cdot 5 \cdot 5 \cdot 5$

89. False; the prime factorization of 102 is $2 \cdot 3 \cdot 17$.

Critical Thinking

91. Answers will vary. For example, 21, 33, 27, and 39.

Projects or Group Activities

93. Answers will vary.

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41
43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

Chapter 1 Review Exercises

1. $3 \cdot 2^3 \cdot 5^2 = 3 \cdot 8 \cdot 25$
$= 24 \cdot 25 = 600$

2. 10,000 + 300 + 20 + 7

3. $18 \div 1 = 18$
$18 \div 2 = 9$
$18 \div 3 = 6$
$18 \div 6 = 3$
Factors are 1, 2, 3, 6, 9, and 18.

4.
$$\begin{array}{r} \scriptstyle 1\,1\,1 \\ 5894 \\ 6301 \\ +\ \ 298 \\ \hline 12{,}493 \end{array}$$

5.
$$\begin{array}{r} \scriptstyle 8\ \ 11\ \ 16 \\ 4\,\not{9}\,\not{2}\,\not{6} \\ -3\,1\,7\,7 \\ \hline 1\,7\,4\,9 \end{array}$$

6.
$$\begin{array}{r} 2\,135 \\ 7\overline{)14{,}945} \\ -14 \\ \hline 09 \\ -\ 7 \\ \hline 24 \\ -21 \\ \hline 35 \\ -35 \\ \hline 0 \end{array}$$

7. 101 > 87

8. $5 \cdot 5 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 = 5^2 \cdot 7^5$

9.
$$\begin{array}{r} \scriptstyle 6 \\ 2019 \\ \times\ \ 307 \\ \hline 14133 \\ 60570\ \\ \hline 619{,}833 \end{array}$$

10.
$$\begin{array}{r} \scriptstyle 9 \\ \scriptstyle 0\,10\,11\,2\,14 \\ \not{1}\not{0}{,}\not{1}\not{3}\not{4} \\ -\ \ 4\,725 \\ \hline 5\,409 \end{array}$$

11.
$$\begin{array}{r} \scriptstyle 1\,1\ \\ 298 \\ 461 \\ +\ 322 \\ \hline 1081 \end{array}$$

12. $2^3 - 3 \cdot 2 = 8 - 3 \cdot 2 = 8 - 6 = 2$

13. 45,700

14. Two hundred seventy-six thousand fifty-seven

15.
$$\begin{array}{r} 1306 \quad \text{r59} \\ 84\overline{)109{,}763} \\ -84 \\ \hline 257 \\ -252 \\ \hline 56 \\ -\ 0 \\ \hline 563 \\ -504 \\ \hline 59 \end{array}$$

16. 2,011,044

17.
$$\begin{array}{r} 488 \quad \text{r2} \\ 8\overline{)3906} \\ -32 \\ \hline 70 \\ -64 \\ \hline 66 \\ -64 \\ \hline 2 \end{array}$$

18. $3^2 + 2^2 \cdot (5 - 3) = 3^2 + 2^2 \cdot (2)$
$= 9 + 4 \cdot 2$
$= 9 + 8 = 17$

19. $8 \cdot (6 - 2)^2 \div 4 = 8 \cdot 4^2 \div 4$
$= 8 \cdot 16 \div 4$
$= 128 \cdot 4 = 32$

20.

72	
2	36
2	18
2	9
3	3
3	1

$72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$

21. 2133

22.

$$\begin{array}{r} 843 \\ \times\ 27 \\ \hline 5901 \\ 1686 \\ \hline 22,761 \end{array}$$

23. **Strategy** To find the total pay for last week's work:

• Multiply the overtime rate ($24) by the number of hours worked (12).

• Add the total earned as overtime to the assistant's salary ($480).

Solution

$$\begin{array}{r} 24 \\ \times 12 \\ \hline 48 \\ 24 \\ \hline 288 \end{array} \qquad \begin{array}{r} 480 \\ +\ 288 \\ \hline 768 \end{array}$$

The total pay for last week's work is $768.

24. **Strategy** To find the number of miles driven per gallon of gasoline, divide the total number of miles driven (351) by the number of gallons used (13).

Solution

$$\begin{array}{r} 27 \\ 13\overline{)351} \\ -26 \\ \hline 91 \\ -91 \\ \hline 0 \end{array}$$

He drove 27 miles per gallon of gasoline.

25. **Strategy** To find the monthly car payment:

• Subtract the down payment ($3000) from the cost of the car ($29,880) to find the balance.

• Divide the balance by the number of equal payments (48).

Solution

$$\begin{array}{r} 29,880 \\ -\ 3,000 \\ \hline 26,880 \end{array} \qquad \begin{array}{r} 560 \\ 48\overline{)26,880} \\ -240 \\ \hline 288 \\ -288 \\ \hline 00 \\ -\ 0 \\ \hline 0 \end{array}$$

Each monthly car payment is $560.

26. **Strategy** To find the total income from commissions, add the amounts received for each of the 4 weeks ($723, $544, $812, and $488).

Solution

$$\begin{array}{r} 723 \\ 544 \\ 812 \\ +488 \\ \hline 2567 \end{array}$$

The total income from commissions is $2567.

27. **Strategy** To find the total amount deposited, add the two deposits ($88 and $213). To find the new checking account balance, add the total amount deposited ($301) to the original balance ($516).

Solution

$$\begin{array}{r} 88 \\ +213 \\ \hline 301 \end{array}$$

The total amount deposit is $301.

$$\begin{array}{r} 301 \\ +516 \\ \hline 817 \end{array}$$

The new checking balance is $817.

28. **Strategy** To find the total of the car payments over a 12-month period, multiply the amount of

each payment ($246) by the number of payments (12).

Solution

$$\begin{array}{r} 246 \\ \times\ 12 \\ \hline 492 \\ 246 \\ \hline 2952 \end{array}$$

The total of the car payment is $2952.

29. Strategy To find the year that there were more males enrolled in U.S. colleges, read the values from the table and determine which number is larger.

Solution 7,455,925 < 8,769,504

Since 8,769,504 is associated with the year 2009, there were more males enrolled in U.S. colleges in 2009 than in 2005.

30. Strategy To find the difference between the number of males and the number of females enrolled in U.S. colleges in 2005, subtract the values given in the table.

Solution

$$\begin{array}{rl} 10,031,550 & \text{males} \\ -\ 7,455,925 & \text{females} \\ \hline 2,575,625 & \end{array}$$

The difference between the numbers of males and females enrolled in U.S. colleges in 2005 was 2,575,625 students.

31. Strategy To find the increase in the number of males enrolled in U.S. colleges from 2005 to 2009, subtract the number in 2005 (7,455,925) from the number in 2009 (8,769,504).

Solution

$$\begin{array}{r} 8,769,504 \\ -7,455,925 \\ \hline 1,313,579 \end{array}$$

The number of males enrolled in U.S. colleges increased by 1,313,579 males from 2005 to 2009.

32. Strategy To find how many more students were enrolled in U.S colleges in 2009 than in 2005:

• Add the number of male and female students in 2005.

• Add the number of male and female students in 2009.

• Subtract these two sums to find the increase.

Solution

$$\begin{array}{rl} \underline{2005}: & 7,455,925 \quad \text{males} \\ & +10,031,550 \quad \text{females} \\ \hline & 17,487,475 \end{array}$$

$$\begin{array}{rl} \underline{2009}: & 8,769,504 \quad \text{males} \\ & +\ 11,658,207 \quad \text{females} \\ \hline & 20,427,711 \end{array}$$

$$\begin{array}{rl} & 20,427,711 \quad 2009 \\ -17,487,475 & \quad 2005 \\ \hline & 2,940,236 \end{array}$$

2,940,236 more students were enrolled in U.S. colleges in 2009 than in 2005.

Chapter 1 Test

1. $3^3 \cdot 4^2 = 27 \cdot 16 = 432$

2. Two hundred seven thousand sixty-eight

3.
$$\begin{array}{r} {}^{1}\,{}^{12}\,\ \ {}^{9}\,{}^{9}\,{}^{16} \\ \not{2}\,\not{3},\not{0}\,\not{0}\,\not{6} \\ -\ 7\,9\,3\,7 \\ \hline 1\,5,0\,6\,9 \end{array}$$

4. $20 \div 1 = 20$
$20 \div 2 = 10$
$20 \div 4 = 5$
$20 \div 5 = 4$
Factors are 1, 2, 4, 5, 10, and 20.

5.
$$\begin{array}{r} 9736 \\ \times\ \ 704 \\ \hline 38{,}944 \\ 681{,}520 \\ \hline 6{,}854{,}144 \end{array}$$

6.
$$\begin{aligned} 4^2 \cdot (4 - 2) \div 8 + 5 &= 4^2 \cdot (2) \div 8 + 5 \\ &= 16 \cdot (2) \div 8 + 5 \\ &= 32 \div 8 + 5 \\ &= 4 + 5 = 9 \end{aligned}$$

7. 900,000 + 6000 + 300 + 70 + 8

8. 75,000

9.
$$\begin{array}{r} 1121 \text{ r27} \\ 97\overline{)108{,}764} \\ -97 \\ \hline 117 \\ -97 \\ \hline 206 \\ -194 \\ \hline 124 \\ -\ 97 \\ \hline 27 \end{array}$$

10. $3 \cdot 3 \cdot 3 \cdot 7 \cdot 7 = 3^3 \cdot 7^2$

11.
$$\begin{array}{r} {}^{2}\ \ \ {}^{2\,1}\ \ \\ 8{,}756 \\ 9{,}094 \\ +\ 37{,}065 \\ \hline 54{,}915 \end{array}$$

12. $84 = 2 \cdot 2 \cdot 3 \cdot 7$

	84
2	42
2	21
3	7
1	1

13.
$$\begin{aligned} 16 \div 4 \cdot 2 - (7 - 5)^2 &= 16 \div 4 \cdot 2 - 2^2 \\ &= 16 \div 4 \cdot 2 - 4 \\ &= 4 \cdot 2 - 4 \\ &= 8 - 4 = 4 \end{aligned}$$

14.
$$\begin{array}{r} {}^{6}\ \ \ {}^{5\,2}\ \\ 90{,}763 \\ \times\ \ \ \ \ \ 8 \\ \hline 726{,}104 \end{array}$$

15. 1,204,006

16.
$$\begin{array}{r} 8710 \text{ r2} \\ 7\overline{)60972} \\ -56 \\ \hline 49 \\ -49 \\ \hline 07 \\ -\ 7 \\ \hline 02 \\ -\ 0 \\ \hline 2 \end{array}$$

17. $21 > 19$

18.
$$\begin{array}{r} 703 \\ 8\overline{)5624} \\ -56 \\ \hline 02 \\ -\ 0 \\ \hline 24 \\ -24 \\ \hline 0 \end{array}$$

19.
$$\begin{array}{r} 25{,}492 \\ +71{,}306 \\ \hline 96{,}798 \end{array}$$

20.
$$\begin{array}{r} {}^{1\ 18\ 17}\ \ \ \ \ \\ \not{2}\not{9},\not{7}36 \\ -\ \ 9{,}814 \\ \hline 19{,}922 \end{array}$$

21. **Strategy** To find the difference between the total enrollment in 2016 and 2013:
- Add the numbers in the two columns for 2013 to find the total enrollment for 2013.
- Add the numbers in the two

columns for 2016 to find the total enrollment for 2016.

• Subtract the two values to find the difference.

Solution

$$\begin{array}{rll} \underline{2013}: & 41{,}873{,}000 & \text{K}-8 \\ & +16{,}000{,}000 & 9-12 \\ \hline & 57{,}873{,}000 & \end{array}$$

$$\begin{array}{rll} \underline{2016}: & 43{,}097{,}000 & \text{K}-8 \\ & +16{,}684{,}000 & 9-12 \\ \hline & 59{,}781{,}000 & \end{array}$$

$$\begin{array}{rl} 59{,}781{,}000 & 2016 \\ -57{,}873{,}000 & 2013 \\ \hline 1{,}908{,}000 & \end{array}$$

The difference in projected total enrollment between 2016 and 2013 is 1,908,000 students.

22. Strategy To find the number of students projected to be enrolled in pre-kindergarten through grade 12 in 2016, read the table to find the number of students projected to be in each of these grade groups. Then add the numbers.

Solution

$$\begin{array}{r} 43{,}097{,}000 \\ +\ 16{,}684{,}000 \\ \hline 59{,}781{,}000 \end{array}$$

In 2016, there are 59,781,000 students projected to be enrolled in pre-kindergarten through grade 12.

23. Strategy To find how many boxes were needed to pack the lemons:

• Find the total number of lemons harvested by adding the amounts harvested from the two groves (48,290 and 23,710 pounds).

• Divide the total number of pounds harvested by the number of pounds of lemons that can be packed in each box (24).

Solution

$$\begin{array}{r} 48{,}290 \\ +23{,}710 \\ \hline 72{,}000 \end{array}$$

$$\begin{array}{r} 3000 \\ 24\overline{)\,72{,}000} \\ \underline{-72} \\ 00 \\ \underline{-\ 0} \\ 00 \\ \underline{-\ 0} \\ 00 \\ \underline{-\ 0} \\ 0 \end{array}$$

3000 boxes were needed to pack the lemons.

24. Strategy To find the number of times a hummingbird beats its wings in 900 seconds, multiply the number of beats per second (52) by the number of seconds (900).

Solution

$$\begin{array}{r} 52 \\ \times\ 900 \\ \hline 46{,}800 \end{array}$$

A hummingbird beats its wings 46,800 times in 900 seconds.

25. Strategy To find the average speed:

- Add the speeds for the 12 cars.
- Divide the sum by 12.

Solution

$$\begin{array}{r} 68 \\ 73 \\ 59 \\ 77 \\ 65 \\ 52 \\ 71 \\ 68 \\ 76 \\ 64 \\ 59 \\ +\,60 \\ \hline 792 \end{array}$$

$$\begin{array}{r} 66 \\ 12\overline{)792} \\ -72 \\ \hline 72 \\ -72 \\ \hline 0 \end{array}$$

The average speed was 66 miles per hour.

Chapter 2: Fractions

Prep Test

1. 20

2. 120

3. 9

4. 10

5. 7

6.
$$\begin{array}{r} 2 \text{ r3} \\ 30\overline{)63} \\ -60 \\ \hline 3 \end{array}$$

7. 1, 2, 3, 4, 6, 12

8. $8 \cdot 7 + 3 = 56 + 3 = 59$

9. 7

10. <

Section 2.1

Concept Check

1. 5, 10, 15, 20

3. 10, 20, 30, 40

5. Multiples of 6: 6, 12, 18, 24, 30, 36, 42, 48, 54, 60

Multiples of 8: 8, 16, 24, 32, 40, 48, 56, 64, 72, 80

Common multiples: 24, 48

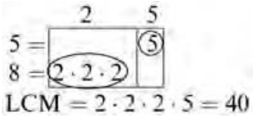
Least common multiple: 24

7. 1, 2, 4, 5, 10, 20

9. 1, 2, 4, 7, 14, 28

Objective A Exercises

11.



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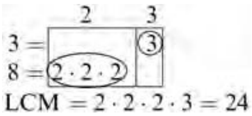

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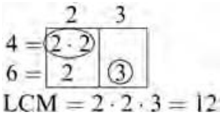

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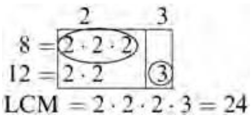

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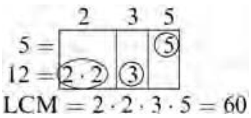

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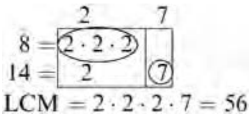

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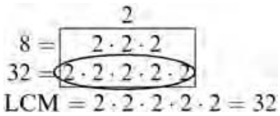

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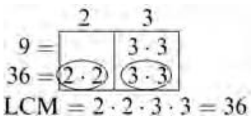

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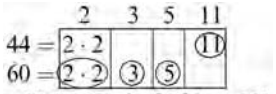
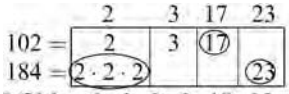


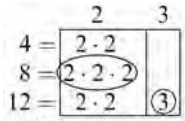
LCM $= 2 \cdot 3 \cdot 5 \cdot 11 = 660$

29.



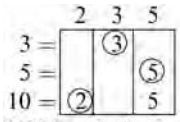
LCM $= 2 \cdot 2 \cdot 2 \cdot 3 \cdot 17 \cdot 23 = 9384$

31.



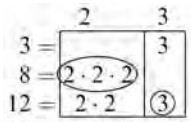
LCM $= 2 \cdot 2 \cdot 2 \cdot 3 = 24$

33.



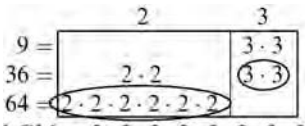
LCM $= 2 \cdot 3 \cdot 5 = 30$

35.



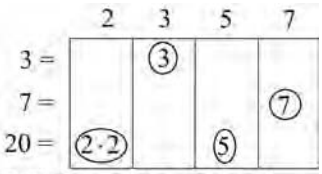
LCM $= 2 \cdot 2 \cdot 2 \cdot 3 = 24$

37.



LCM $= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 576$

39.

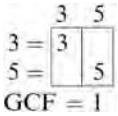


LCM $= 2 \cdot 2 \cdot 3 \cdot 5 \cdot 7 = 420$

41. True

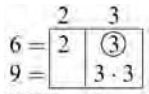
Objective B Exercises

43.



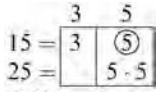
GCF $= 1$

45.



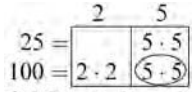
GCF $= 3$

47.



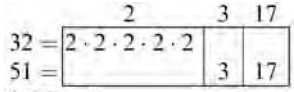
GCF $= 5$

49.



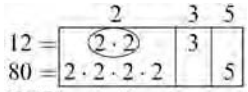
GCF $= 5 \cdot 5 = 25$

51.



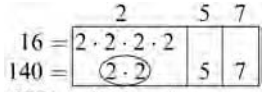
GCF $= 1$

53.



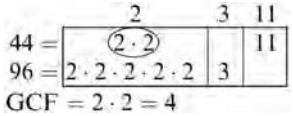
GCF $= 2 \cdot 2 = 4$

55.



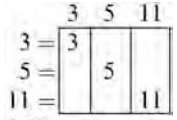
GCF $= 2 \cdot 2 = 4$

57.



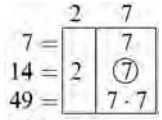
GCF $= 2 \cdot 2 = 4$

59.



GCF $= 1$

61.



GCF $= 7$

63.

	2	3	5
$10 =$	2		5
$15 =$		3	5
$20 =$	$2 \cdot 2$		(5)

$\text{GCF} = 5$

65.

	2	3	5
$24 =$	$2 \cdot 2 \cdot 2$	3	
$40 =$	$2 \cdot 2 \cdot 2$		5
$72 =$	(2 · 2 · 2)	$3 \cdot 3$	

$\text{GCF} = 2 \cdot 2 \cdot 2 = 8$

67.

	3	17	31
$17 =$		17	
$31 =$			31
$81 =$	$3 \cdot 3 \cdot 3 \cdot 3$		

$\text{GCF} = 1$

69.

	5
$25 =$	(5 · 5)
$125 =$	$5 \cdot 5 \cdot 5$
$625 =$	$5 \cdot 5 \cdot 5 \cdot 5$

$\text{GCF} = 25$

71.

	2	3	7
$32 =$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$		
$56 =$	$2 \cdot 2 \cdot 2$		7
$72 =$	(2 · 2 · 2)	$3 \cdot 3$	

$\text{GCF} = 2 \cdot 2 \cdot 2 = 8$

73. True

Critical Thinking

75. Joe has a 4-day cycle (3 workdays + 1 day off). Raya has a 6-day cycle (5 workdays + 1 day off). The least common multiple of 4 and 6 is 12. After Joe and Raya have a day off together, they will have another day off together in 12 days.

77. The GCF of 3 and 5 is 1. The GCF of 7 and 11 is 1. The GCF of 29 and 43 is 1. Because two prime numbers do not have a common factor other than 1, the GCF of two prime numbers is 1. Because three prime numbers do not have a common factor other than 1, the GCF of three prime numbers is 1.

Projects or Group Activities

79a. No; the GCF of 48 and 50 is 4. 48 and 50 are not coprime.

b. Yes; $25 = 5 \cdot 5$ and $36 = 2 \cdot 2 \cdot 3 \cdot 3$, so their GCF is 1.

c. Yes; $22 = 2 \cdot 11$ and $27 = 3 \cdot 3 \cdot 3$, so their GCF is 1.

d. Yes; 71 and 73 are both prime numbers, so their GCF is 1.

Section 2.2

Concept Check

1. Improper fraction; greater than 1

3. Proper fraction; less than 1

Objective A Exercises

5. $\frac{3}{4}$

7. $\frac{7}{8}$

9. $1\frac{1}{2}$

11. $2\frac{5}{8}$

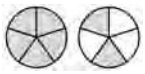
13. $3\frac{3}{5}$

15. $\frac{5}{4}$

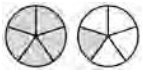
17. $\frac{8}{3}$

19. $\frac{27}{8}$

21.



23.



25. False

Objective B Exercises

27. $3\overline{)16}$ $\quad \frac{16}{3} = 5\frac{1}{3}$

-15

1

29. $9\overline{)18}$ $\quad \frac{18}{9} = 2$

-18

0

31. $4\overline{)13}$ $\quad \frac{13}{4} = 3\frac{1}{4}$

-12

1

33. $2\overline{)29}$ $\quad \frac{29}{2} = 14\frac{1}{2}$

-2

09

-8

1

35. $3\overline{)51}$ $\quad \frac{51}{3} = 17$

-3

21

-21

0

37. $9\overline{)16}$ $\quad \frac{16}{9} = 1\frac{7}{9}$

-9

7

39. $5\overline{)9}$ $\quad \frac{9}{5} = 1\frac{4}{5}$

-5

4

41. $1\overline{)23}$ $\quad \frac{23}{1} = 23$

-2

03

-3

0

43. $16\overline{)31}$ $\quad \frac{31}{16} = 1\frac{15}{16}$

-16

15

45. $3\overline{)19}$ $\quad \frac{19}{3} = 6\frac{1}{3}$

-18

1

47. $8\overline{)40}$ $\quad \frac{40}{8} = 5$

-40

0

49. $3\overline{)3}$ $\quad \frac{3}{3} = 1$

-3

0

51. $4\frac{2}{3} = \frac{12+2}{3} = \frac{14}{3}$

53. $8\frac{2}{3} = \frac{24+2}{3} = \frac{26}{3}$

55. $7\frac{3}{8} = \frac{56+3}{8} = \frac{59}{8}$

57. $6\frac{1}{4} = \frac{24+1}{4} = \frac{25}{4}$

59. $15\frac{1}{8} = \frac{120+1}{8} = \frac{121}{8}$

61. $3\frac{5}{12} = \frac{36+5}{12} = \frac{41}{12}$

63. $3\frac{7}{9} = \frac{27+7}{9} = \frac{34}{9}$

65. $12\frac{2}{3} = \frac{36+2}{3} = \frac{38}{3}$

67. $5\frac{3}{7} = \frac{35+3}{7} = \frac{38}{7}$

69. $12\frac{3}{5} = \frac{60+3}{5} = \frac{63}{5}$

71. $4\frac{5}{9} = \frac{36+5}{9} = \frac{41}{9}$

73. $8\frac{5}{14} = \frac{112+5}{14} = \frac{117}{14}$

Critical Thinking

75. Students might mention any of the following: fractional parts of an hour, as in three-quarters of an hour; lengths of nails, as in $\frac{3}{4}$-inch nail; lengths of fabric, as in $1\frac{5}{8}$ yards of material; lengths of lumber, as in $2\frac{1}{2}$ feet of pine; ingredients in a recipe, as in $1\frac{1}{2}$ cups sugar; or innings pitched, as in four and two-thirds innings.

Projects or Group Activities

77. Answers will vary. For example, $\frac{17}{8}$

Section 2.3

Concept Check

1. No. 5 does not divide into 7 evenly.

Objective A Exercises

3. $10 \div 2 = 5; \frac{1 \cdot 5}{2 \cdot 5} = \frac{5}{10}$

5. $48 \div 16 = 3; \frac{3 \cdot 3}{16 \cdot 3} = \frac{9}{48}$

7. $32 \div 8 = 4; \frac{3 \cdot 4}{8 \cdot 4} = \frac{12}{32}$

9. $51 \div 17 = 3; \frac{3 \cdot 3}{17 \cdot 3} = \frac{9}{51}$

11. $16 \div 4 = 4; \frac{3 \cdot 4}{4 \cdot 4} = \frac{12}{16}$

13. $9 \div 1 = 9; \frac{3 \cdot 9}{1 \cdot 9} = \frac{27}{9}$

15. $60 \div 3 = 20; \frac{1 \cdot 20}{3 \cdot 20} = \frac{20}{60}$

17. $60 \div 15 = 4; \frac{11 \cdot 4}{15 \cdot 4} = \frac{44}{60}$

19. $18 \div 3 = 6; \frac{2 \cdot 6}{3 \cdot 6} = \frac{12}{18}$

21. $49 \div 7 = 7; \frac{5 \cdot 7}{7 \cdot 7} = \frac{35}{49}$

23. $18 \div 9 = 2; \frac{5 \cdot 2}{9 \cdot 2} = \frac{10}{18}$

25. $3 \div 1 = 3; \frac{7 \cdot 3}{1 \cdot 3} = \frac{21}{3}$

27. $45 \div 9 = 5; \frac{7 \cdot 5}{9 \cdot 5} = \frac{35}{45}$

29. $64 \div 16 = 4; \frac{15 \cdot 4}{16 \cdot 4} = \frac{60}{64}$

31. $98 \div 14 = 7; \frac{3 \cdot 7}{14 \cdot 7} = \frac{21}{98}$

33. $48 \div 8 = 6; \frac{5 \cdot 6}{8 \cdot 6} = \frac{30}{48}$

35. $42 \div 14 = 3; \frac{5 \cdot 3}{14 \cdot 3} = \frac{15}{42}$

37. $144 \div 24 = 6; \frac{17 \cdot 6}{24 \cdot 6} = \frac{102}{144}$

Objective B Exercises

39. $\frac{4}{12} = \frac{\overset{1}{2} \cdot \overset{1}{2}}{\underset{1}{2} \cdot \underset{1}{2} \cdot 3} = \frac{1}{3}$

41. $\frac{22}{44} = \frac{\overset{1}{2} \cdot \overset{1}{11}}{\underset{1}{2} \cdot 2 \cdot \underset{1}{11}} = \frac{1}{2}$

43. $\frac{2}{12} = \frac{\overset{1}{2}}{\underset{1}{2} \cdot 2 \cdot 3} = \frac{1}{6}$

45. $\frac{40}{36} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot 2 \cdot 5}{\underset{1}{2} \cdot \underset{1}{2} \cdot 3 \cdot 3} = \frac{10}{9} = 1\frac{1}{9}$

47. $\frac{0}{30} = 0$

49. $\frac{9}{22} = \frac{3 \cdot 3}{2 \cdot 11} = \frac{9}{22}$

51. $\frac{75}{25} = \frac{3 \cdot \overset{1}{5} \cdot \overset{1}{5}}{\underset{1}{5} \cdot \underset{1}{5}} = 3$

53. $\frac{16}{84} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot 2 \cdot 2}{\underset{1}{2} \cdot \underset{1}{2} \cdot 3 \cdot 7} = \frac{4}{21}$

55. $\frac{12}{35} = \frac{2 \cdot 2 \cdot 3}{5 \cdot 7} = \frac{12}{35}$

57. $\frac{28}{44} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot 7}{\underset{1}{2} \cdot \underset{1}{2} \cdot 11} = \frac{7}{11}$

59. $\frac{16}{12} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot 2 \cdot 2}{\underset{1}{2} \cdot \underset{1}{2} \cdot 3} = \frac{4}{3} = 1\frac{1}{3}$

61. $\frac{24}{40} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot 3}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot 5} = \frac{3}{5}$

63. $\frac{8}{88} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2}}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot 11} = \frac{1}{11}$

65. $\frac{144}{36} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot 2 \cdot 2 \cdot \overset{1}{3} \cdot \overset{1}{3}}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{3} \cdot \underset{1}{3}} = 4$

67. $\frac{48}{144} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{3}}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{3} \cdot 3} = \frac{1}{3}$

69. $\frac{60}{100} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot 3 \cdot \overset{1}{5}}{\underset{1}{2} \cdot \underset{1}{2} \cdot 5 \cdot \underset{1}{5}} = \frac{3}{5}$

71. $\frac{36}{16} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot 3 \cdot 3}{\underset{1}{2} \cdot \underset{1}{2} \cdot 2 \cdot 2} = \frac{9}{4} = 2\frac{1}{4}$

73. $\frac{32}{160} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2}}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot 5} = \frac{1}{5}$

Critical Thinking

75. Answers will vary. For example,

$\frac{4}{6}$, $\frac{6}{9}$, $\frac{8}{12}$, $\frac{10}{15}$, and $\frac{12}{18}$ are fractions that are equal to $\frac{2}{3}$.

Projects or Group Activities

77a. Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana

$\frac{8}{50} = \frac{4}{25}$

b. Alabama, Alaska, Arizona, Idaho, Indiana, Iowa, Ohio, Oklahoma

$\frac{8}{50} = \frac{4}{25}$

Section 2.4

Concept Check

1. $\frac{2}{9}+\frac{5}{9}=\frac{2+5}{9}=\frac{7}{9}$

3. 8

5. 18

Objective A Exercises

7.
$$\begin{array}{r} \frac{2}{7} \\ +\frac{1}{7} \\ \hline \frac{3}{7} \end{array}$$

9.
$$\begin{array}{r} \frac{2}{9} \\ +\frac{4}{9} \\ \hline \frac{6}{9}=\frac{2}{3} \end{array}$$

11.
$$\begin{array}{r} \frac{3}{14} \\ +\frac{5}{14} \\ \hline \frac{8}{14}=\frac{4}{7} \end{array}$$

13.
$$\begin{array}{r} \frac{1}{2} \\ +\frac{1}{2} \\ \hline \frac{2}{2}=1 \end{array}$$

15.
$$\begin{array}{r} \frac{8}{11} \\ +\frac{7}{11} \\ \hline \frac{15}{11}=1\frac{4}{11} \end{array}$$

17.
$$\begin{array}{r} \frac{8}{5} \\ +\frac{9}{5} \\ \hline \frac{17}{5}=3\frac{2}{5} \end{array}$$

19.
$$\begin{array}{r} \frac{3}{8} \\ \frac{7}{8} \\ +\frac{1}{8} \\ \hline \frac{11}{8}=1\frac{3}{8} \end{array}$$

21.
$$\begin{array}{r} \frac{4}{15} \\ \frac{7}{15} \\ +\frac{11}{15} \\ \hline \frac{22}{15}=1\frac{7}{15} \end{array}$$

23. $\frac{5}{12}+\frac{1}{12}+\frac{11}{12}=\frac{17}{12}=1\frac{5}{12}$

25. A whole number other than 1

27. The number 1

Objective B Exercises

29.
$$\begin{array}{r} \frac{1}{2}=\frac{3}{6} \\ +\frac{2}{3}=\frac{4}{6} \\ \hline \frac{7}{6}=1\frac{1}{6} \end{array}$$

31.
$$\begin{array}{r} \frac{3}{14}=\frac{3}{14} \\ +\frac{5}{7}=\frac{10}{14} \\ \hline \frac{13}{14} \end{array}$$

33.
$$\begin{array}{r} \frac{8}{15}=\frac{32}{60} \\ +\frac{7}{20}=\frac{21}{60} \\ \hline \frac{53}{60} \end{array}$$

35.
$$\begin{array}{r} \frac{3}{8}=\frac{21}{56} \\ +\frac{9}{14}=\frac{36}{56} \\ \hline \frac{57}{56}=1\frac{1}{56} \end{array}$$

37.
$$\begin{array}{r} \frac{3}{20}=\frac{9}{60} \\ +\frac{7}{30}=\frac{14}{60} \\ \hline \frac{23}{60} \end{array}$$

39.
$$\begin{array}{r} \frac{1}{3}=\frac{6}{18} \\ \frac{5}{6}=\frac{15}{18} \\ +\frac{7}{9}=\frac{14}{18} \\ \hline \frac{35}{18}=1\frac{17}{18} \end{array}$$

41.
$$\begin{array}{r} \frac{5}{6}=\frac{40}{48} \\ \frac{1}{12}=\frac{4}{48} \\ +\frac{5}{16}=\frac{15}{48} \\ \hline \frac{59}{48}=1\frac{11}{48} \end{array}$$

43.
$$\begin{array}{r} \frac{2}{3}=\frac{40}{60} \\ \frac{1}{5}=\frac{12}{60} \\ +\frac{7}{12}=\frac{35}{60} \\ \hline \frac{87}{60}=1\frac{27}{60}=1\frac{9}{20} \end{array}$$

45.
$$\begin{array}{r} \frac{2}{3}=\frac{80}{120} \\ \frac{3}{5}=\frac{72}{120} \\ +\frac{7}{8}=\frac{105}{120} \\ \hline \frac{257}{120}=2\frac{17}{120} \end{array}$$

47.
$$\begin{array}{r} \frac{2}{3}=\frac{48}{72} \\ \frac{5}{8}=\frac{45}{72} \\ +\frac{7}{9}=\frac{56}{72} \\ \hline \frac{149}{72}=2\frac{5}{72} \end{array}$$

49.
$$\begin{array}{r} \frac{3}{8}=\frac{15}{40} \\ +\frac{3}{5}=\frac{24}{40} \\ \hline \frac{39}{40} \end{array}$$

51.
$$\begin{array}{r} \frac{3}{8}=\frac{9}{24} \\ \frac{5}{6}=\frac{20}{24} \\ +\frac{7}{12}=\frac{14}{24} \\ \hline \frac{43}{24}=1\frac{19}{24} \end{array}$$

53. (ii)

Objective C Exercises

55.
$$\begin{array}{r} 4\frac{1}{2}=4\frac{6}{12} \\ +5\frac{7}{12}=5\frac{7}{12} \\ \hline 9\frac{13}{12}=10\frac{1}{12} \end{array}$$

57.
$$\begin{array}{r} 4 \\ +5\frac{2}{7} \\ \hline 9\frac{2}{7} \end{array}$$

59.
$$\begin{array}{r} 7\frac{5}{12} = 7\frac{20}{48} \\ +2\frac{9}{16} = 2\frac{27}{48} \\ \hline 9\frac{47}{48} \end{array}$$

61.
$$\begin{array}{r} 6 \\ +2\frac{3}{13} \\ \hline 8\frac{3}{13} \end{array}$$

63.
$$\begin{array}{r} 8\frac{29}{30} = 8\frac{116}{120} \\ +7\frac{11}{40} = 7\frac{33}{120} \\ \hline 15\frac{149}{120} = 16\frac{29}{120} \end{array}$$

65.
$$\begin{array}{r} 17\frac{3}{8} = 17\frac{15}{40} \\ +\ 7\frac{7}{20} = \ 7\frac{14}{40} \\ \hline 24\frac{29}{40} \end{array}$$

67.
$$\begin{array}{r} 5\frac{7}{8} = \ 5\frac{21}{24} \\ +27\frac{5}{12} = 27\frac{10}{24} \\ \hline 32\frac{31}{24} = 33\frac{7}{24} \end{array}$$

69.
$$\begin{array}{r} 7\frac{5}{9} = 7\frac{20}{36} \\ +2\frac{7}{12} = 2\frac{21}{36} \\ \hline 9\frac{41}{36} = 10\frac{5}{36} \end{array}$$

71.
$$\begin{array}{r} 2\frac{1}{2} = 2\frac{6}{12} \\ 3\frac{2}{3} = 3\frac{8}{12} \\ +4\frac{1}{4} = 4\frac{3}{12} \\ \hline 9\frac{17}{12} = 10\frac{5}{12} \end{array}$$

73.
$$\begin{array}{r} 3\frac{1}{2} = 3\frac{45}{90} \\ 3\frac{1}{5} = 3\frac{18}{90} \\ +8\frac{1}{9} = 8\frac{10}{90} \\ \hline 14\frac{73}{90} \end{array}$$

75.
$$\begin{array}{r} 2\frac{3}{8} = 2\frac{18}{48} \\ 4\frac{7}{12} = 4\frac{28}{48} \\ +3\frac{5}{16} = 3\frac{15}{48} \\ \hline 9\frac{61}{48} = 10\frac{13}{48} \end{array}$$

77.
$$\begin{array}{r} 6\frac{3}{8} = 6\frac{3}{8} \\ +\ 3\frac{1}{2} = 3\frac{4}{8} \\ \hline 9\frac{7}{8} \end{array}$$

The pole is $9\frac{7}{8}$ feet long.

79.
$$\begin{array}{r} 5\frac{5}{6} = 5\frac{20}{24} \\ +3\frac{3}{8} = 3\frac{9}{24} \\ \hline 8\frac{29}{24} = 9\frac{5}{24} \end{array}$$

81.
$$\begin{array}{r} 4\frac{8}{9} = 4\frac{16}{18} \\ +9\frac{1}{6} = 9\frac{3}{18} \\ \hline 13\frac{19}{18} = 14\frac{1}{18} \end{array}$$

83.
$$\begin{array}{r} 1\frac{5}{8} = 1\frac{15}{24} \\ 3 = 3 \\ +7\frac{7}{24} = 7\frac{7}{24} \\ \hline 11\frac{22}{24} = 11\frac{11}{12} \end{array}$$

85. No

Objective D Exercises

87. **Strategy** To find the length of the shaft, add the lengths of the three parts $\left(\frac{5}{16},\ 6\frac{7}{8},\ \text{and } 1\frac{3}{8} \text{ inches}\right)$.

Solution

$$\begin{array}{r} \frac{5}{16} = \frac{5}{16} \\ 6\frac{7}{8} = 6\frac{14}{16} \\ +1\frac{3}{8} = 1\frac{6}{16} \\ \hline 7\frac{25}{16} = 8\frac{9}{16} \end{array}$$

The length of the shaft is $8\frac{9}{16}$ inches.

89. The sum represents the height of the table.

91. **Strategy** To find the total length of the course, add the three sides $\left(4\frac{3}{10},\ 3\frac{7}{10}, \text{and } 2\frac{1}{2} \text{ miles}\right)$.

Solution

$$\begin{array}{r} 4\frac{3}{10} = 4\frac{3}{10} \\ 3\frac{7}{10} = 3\frac{7}{10} \\ +2\frac{1}{2} = 2\frac{5}{10} \\ \hline 9\frac{15}{10} = 10\frac{1}{2} \end{array}$$

The total length of the course is $10\frac{1}{2}$ miles.

93. **Strategy** To find the thickness of the wall, add the thickness of the stud $\left(5\frac{5}{8} \text{ in.}\right)$ to the thickness of the dry wall on each side of the stud $\left(\frac{1}{2} \text{ in.}\right)$.

Solution

$$\begin{array}{r} 5\frac{5}{8} = 5\frac{5}{8} \\ \frac{1}{2} = \frac{4}{8} \\ +\ \frac{1}{2} = \frac{4}{8} \\ \hline 5\frac{13}{8} = 6\frac{5}{8} \end{array}$$

The total thickness of the wall is $6\frac{5}{8}$ in.

95. **Strategy** To find the minimum length of bolt needed, add the thickness of each piece of wood $\left(\frac{1}{2} \text{ in.},\ \frac{5}{8} \text{ in.}\right)$ to the thickness of the washer $\left(\frac{1}{16} \text{ in.}\right)$ and the thickness of the nut $\left(\frac{3}{16} \text{ in.}\right)$.

Solution

$$\begin{array}{r} \frac{1}{2} = \frac{8}{16} \\ \frac{5}{8} = \frac{10}{16} \\ \frac{1}{16} = \frac{1}{16} \\ +\frac{3}{16} = \frac{3}{16} \\ \hline \frac{22}{16} = 1\frac{6}{16} = 1\frac{3}{8} \end{array}$$

The bolt must be $1\frac{3}{8}$ in. long.

Projects or Group Activities

97. $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$

99. $\frac{7}{12} = \frac{4}{12} + \frac{3}{12} = \frac{1}{3} + \frac{1}{4}$

101. $\frac{5}{12} = \frac{3}{12} + \frac{2}{12} = \frac{1}{4} + \frac{1}{6}$

Section 2.5

Concept Check

1. $\frac{5}{11} - \frac{3}{11} = \frac{5-3}{11} = \frac{2}{11}$

3. $\frac{11}{18}$

Objective A Exercises

5.
$$\begin{array}{r} \frac{9}{17} \\ -\frac{7}{17} \\ \hline \frac{2}{17} \end{array}$$

7.
$$\begin{array}{r} \frac{11}{12} \\ -\frac{7}{12} \\ \hline \frac{4}{12} = \frac{1}{3} \end{array}$$

9.
$$\begin{array}{r} \frac{9}{20} \\ -\frac{7}{20} \\ \hline \frac{2}{20} = \frac{1}{10} \end{array}$$

11.
$$\begin{array}{r} \frac{42}{65} \\ -\frac{17}{65} \\ \hline \frac{25}{65} = \frac{5}{13} \end{array}$$

13.
$$\begin{array}{r} \frac{23}{30} \\ -\frac{13}{30} \\ \hline \frac{10}{30} = \frac{1}{3} \end{array}$$

15.
$$\begin{array}{r} \frac{13}{14} \\ -\frac{5}{14} \\ \hline \frac{8}{14} = \frac{4}{7} \end{array}$$

17.
$$\begin{array}{r} \frac{17}{24} \\ -\frac{11}{24} \\ \hline \frac{6}{24} = \frac{1}{4} \end{array}$$

19. Yes

Objective B Exercises

21.
$$\begin{array}{r} \frac{2}{3} = \frac{4}{6} \\ -\frac{1}{6} = \frac{1}{6} \\ \hline \frac{3}{6} = \frac{1}{2} \end{array}$$

23.
$$\begin{array}{r} \frac{5}{8} = \frac{35}{56} \\ -\frac{2}{7} = \frac{16}{56} \\ \hline \frac{19}{56} \end{array}$$

25.
$$\begin{array}{r} \frac{5}{7} = \frac{10}{14} \\ -\frac{3}{14} = \frac{3}{14} \\ \hline \frac{7}{14} = \frac{1}{2} \end{array}$$

27.
$$\begin{array}{r} \frac{8}{15} = \frac{32}{60} \\ -\frac{7}{20} = \frac{21}{60} \\ \hline \frac{11}{60} \end{array}$$

29.
$$\begin{array}{r} \frac{9}{16} = \frac{18}{32} \\ -\frac{17}{32} = \frac{17}{32} \\ \hline \frac{1}{32} \end{array}$$

31.
$$\begin{array}{r} \frac{11}{12} = \frac{55}{60} \\ -\frac{3}{5} = \frac{36}{60} \\ \hline \frac{19}{60} \end{array}$$

33.
$$\begin{array}{r} \frac{11}{24} = \frac{33}{72} \\ -\frac{7}{18} = \frac{28}{72} \\ \hline \frac{5}{72} \end{array}$$

35.
$$\begin{array}{r} \frac{11}{12} = \frac{55}{60} \\ -\frac{11}{15} = \frac{44}{60} \\ \hline \frac{11}{60} \end{array}$$

37.
$$\begin{array}{r} \frac{13}{20} = \frac{39}{60} \\ -\frac{1}{6} = \frac{10}{60} \\ \hline \frac{29}{60} \end{array}$$

39. (i)

Objective C Exercises

41.
$$\begin{array}{r} 16\frac{11}{15} \\ -11\frac{8}{15} \\ \hline 5\frac{3}{15} = 5\frac{1}{5} \end{array}$$

43.
$$\begin{array}{r} 5\frac{7}{8} \\ -1 \\ \hline 4\frac{7}{8} \end{array}$$

45.
$$\begin{array}{r} 3 \quad = 2\frac{21}{21} \\ -2\frac{5}{21} = 2\frac{5}{21} \\ \hline \frac{16}{21} \end{array}$$

47.
$$\begin{array}{r} 16\frac{3}{8} = 15\frac{11}{8} \\ -10\frac{7}{8} = 10\frac{7}{8} \\ \hline 5\frac{4}{8} = 5\frac{1}{2} \end{array}$$

49.
$$\begin{array}{r} 23\frac{7}{8} = 23\frac{21}{24} \\ -16\frac{2}{3} = 16\frac{16}{24} \\ \hline 7\frac{5}{24} \end{array}$$

51.
$$\begin{array}{r} 6 = 5\frac{5}{5} \\ -4\frac{3}{5} = 4\frac{3}{5} \\ \hline 1\frac{2}{5} \end{array}$$

53.
$$\begin{array}{r} 40\frac{4}{9} = 40\frac{8}{18} = 39\frac{26}{18} \\ -24\frac{5}{6} = 24\frac{15}{18} = 24\frac{15}{18} \\ \hline 15\frac{11}{18} \end{array}$$

55.
$$\begin{array}{r} 29\frac{1}{2} = 29\frac{2}{4} = 28\frac{6}{4} \\ -7\frac{3}{4} = 7\frac{3}{4} = 7\frac{3}{4} \\ \hline 21\frac{3}{4} \end{array}$$

The distance is $21\frac{3}{4}$ inches.

57.
$$\begin{array}{r} 23\frac{3}{20} = 23\frac{3}{20} = 22\frac{23}{20} \\ -\ 7\frac{3}{5} = \ \ 7\frac{12}{20} = \ 7\frac{12}{20} \\ \hline 15\frac{11}{20} \end{array}$$

59.
$$\begin{array}{r} 10\frac{5}{9} = 10\frac{25}{45} = 9\frac{70}{45} \\ -\ 5\frac{11}{15} = 5\frac{33}{45} = 5\frac{33}{45} \\ \hline 4\frac{37}{45} \end{array}$$

61. No

Objective D Exercises

63. **Strategy** To find the missing dimension, subtract the larger segment of the shaft $\left(2\frac{7}{8} \text{ inches}\right)$ from the total length of the shaft $\left(12\frac{3}{8} \text{ inches}\right)$.

Solution
$$\begin{array}{r} 12\frac{3}{8} = 11\frac{11}{8} \\ -2\frac{7}{8} = 2\frac{7}{8} \\ \hline 9\frac{4}{8} = 9\frac{1}{2} \end{array}$$

The missing dimension is $9\frac{1}{2}$ inches .

65. **Strategy** To find the difference in the heights of the desks, subtract the height of the shorter desk $\left(28\frac{3}{4} \text{ inches}\right)$ from the height of the taller desk $\left(29\frac{1}{2} \text{ inches}\right)$.

Solution
$$\begin{array}{r} 29\frac{1}{2} = 29\frac{2}{4} = 28\frac{6}{4} \\ -\ 28\frac{3}{4} = 28\frac{3}{4} = 28\frac{3}{4} \\ \hline \frac{3}{4} \end{array}$$

The new desk is $\frac{3}{4}$ inch shorter than a desk of standard height.

67a. **Strategy** To find the distance, add the distance to be traveled the first day $\left(7\frac{3}{8}\text{miles}\right)$ to the distance to be traveled the second day $\left(10\frac{1}{3}\text{miles}\right)$.

Solution
$$\begin{array}{r} 7\frac{3}{8} = 7\frac{9}{24} \\ +10\frac{1}{3} = 10\frac{8}{24} \\ \hline 17\frac{17}{24} \end{array}$$

The distance to be traveled during the first 2 days is $17\frac{17}{24}$ miles.

b. **Strategy** To find the distance, subtract the miles hiked $\left(17\frac{17}{24}\right)$ from the total miles $\left(27\frac{1}{2}\right)$.

Solution
$$\begin{array}{r} 27\frac{1}{2} = 27\frac{12}{24} = 26\frac{36}{24} \\ -17\frac{17}{24} = 17\frac{17}{24} = 17\frac{17}{24} \\ \hline 9\frac{19}{24} \end{array}$$

On the third day, $9\frac{19}{24}$ miles remain to be hiked.

69. The difference represents how much farther the hikers plan to travel on the second day than on the first day.

71a. The wrestler has lost $5\frac{1}{4}$ pounds the first week and $4\frac{1}{4}$ pounds the second week. Thus the wrestler has lost more than 9 pounds the first two weeks. Since less than 13 pounds needs to be lost, the wrestler can attain the weight class by losing less than 4 pounds. Yes, this is less than the $4\frac{1}{4}$ pounds lost in the second week.

b. **Strategy** To find how much weight must be lost to reach the desired weight:

- Add the amounts of weight lost during the first 2 weeks $\left(5\frac{1}{4} \text{ and } 4\frac{1}{4} \text{ pounds}\right)$.
- Subtract the total weight lost so far from the amount that is required $\left(12\frac{3}{4} \text{ pounds}\right)$

Solution

$$\begin{array}{r} 5\frac{1}{4} \\ +4\frac{1}{4} \\ \hline 9\frac{2}{4} = 9\frac{1}{2} \end{array} \qquad \begin{array}{r} 12\frac{3}{4} = 12\frac{3}{4} \\ -9\frac{1}{2} = 9\frac{2}{4} \\ \hline 3\frac{1}{4} \end{array}$$

The wrestler needs to lose $3\frac{1}{4}$ pounds to reach the desired weight.

73. The electrician's income is 1, that is, 100%.

$$\begin{array}{r} 1 = \frac{15}{15} \\ -\frac{4}{15} = \frac{4}{15} \\ \hline \frac{11}{15} \end{array}$$

$\frac{11}{15}$ of the electrician's income is not spent for housing.

Critical Thinking

75. To find the missing number, add $1\frac{5}{8}$ and $4\frac{1}{2}$.

$$\begin{array}{r} 1\frac{5}{8} = 1\frac{5}{8} \\ +4\frac{1}{2} = 4\frac{4}{8} \\ \hline 5\frac{9}{8} = 6\frac{1}{8} \end{array}$$

Check Your Progress: Chapter 2

1.

$$\begin{array}{r|cc} & 2 & 3 \\ \hline 12 = & (2\cdot 2) & 3 \\ 18 = & 2 & (3\cdot 3) \end{array}$$

$$\text{LCM} = 2\cdot 2\cdot 3\cdot 3 = 36$$

2.

$$\begin{array}{r|cc} & 2 & 3 \\ \hline 6 = & 2 & 3 \\ 9 = & & 3\cdot 3 \\ 18 = & (2) & (3\cdot 3) \end{array}$$

$$\text{LCM} = 2\cdot 3\cdot 3 = 18$$

3.

	2	5	7
2 =	②		
5 =		⑤	
7 =			⑦

LCM = $2 \cdot 5 \cdot 7 = 70$

4.

	2	3	7
28 =	②·②		⑦
36 =	2·2	③·③	

LCM = $2 \cdot 2 \cdot 3 \cdot 3 \cdot 7 = 252$

5.

	2	3
18 =	②	3·3
24 =	2·2·2	③

GCF = $2 \cdot 3 = 6$

6.

	2	3
27 =		③·③·③
54 =	2	3·3·3

GCF = $3 \cdot 3 \cdot 3 = 27$

7.

	2	3	7
3 =		3	
6 =	2	3	
14 =	2		7

GCF = 1

8.

	2	3	5	7
30 =	2	3	⑤	
70 =	2		5	7
105 =		3	5	7

GCF = 5

9. $\dfrac{36}{45} = \dfrac{2 \cdot 2 \cdot \cancel{3}^{1} \cdot \cancel{3}^{1}}{\cancel{3}_{1} \cdot \cancel{3}_{1} \cdot 5} = \dfrac{4}{5}$

10. $\dfrac{17}{51} = \dfrac{\cancel{17}^{1}}{3 \cdot \cancel{17}_{1}} = \dfrac{1}{3}$

11. $\dfrac{25}{36} = \dfrac{5 \cdot 5}{2 \cdot 2 \cdot 3 \cdot 3}$; $\dfrac{25}{36}$ is in simplest form.

12. $\dfrac{36}{4} = \dfrac{\cancel{2}^{1} \cdot \cancel{2}^{1} \cdot 3 \cdot 3}{\cancel{2}_{1} \cdot \cancel{2}_{1}} = 9$

13.
$$\begin{array}{r} \frac{2}{9} \\ +\frac{4}{9} \\ \hline \frac{6}{9} = \frac{2}{3} \end{array}$$

14.
$$\begin{array}{r} \frac{17}{24} \\ -\frac{5}{24} \\ \hline \frac{12}{24} = \frac{1}{2} \end{array}$$

15.
$$\begin{array}{r} \frac{7}{9} = \frac{14}{18} \\ -\frac{7}{18} = \frac{7}{18} \\ \hline \frac{7}{18} \end{array}$$

16.
$$\begin{array}{r} \frac{7}{20} = \frac{7}{20} \\ +\frac{1}{4} = \frac{5}{20} \\ \hline \frac{12}{20} = \frac{3}{5} \end{array}$$

17.
$$\begin{array}{r} \frac{5}{6} = \frac{40}{48} \\ +\frac{11}{16} = \frac{33}{48} \\ \hline \frac{73}{48} = 1\frac{25}{48} \end{array}$$

18.
$$\begin{array}{r} \frac{3}{4}=\frac{39}{52} \\ -\frac{9}{26}=\frac{18}{52} \\ \hline \frac{21}{52} \end{array}$$

19.
$$\begin{array}{r} \frac{2}{3}=\frac{32}{48} \\ -\frac{3}{16}=\frac{9}{48} \\ \hline \frac{23}{48} \end{array}$$

20.
$$\begin{array}{r} \frac{3}{5}=\frac{12}{20} \\ +\frac{1}{4}=\frac{5}{20} \\ \hline \frac{17}{20} \end{array}$$

21.
$$\begin{array}{r} 2\frac{1}{10}=2\frac{3}{30} \\ +7\frac{1}{15}=7\frac{2}{30} \\ \hline 9\frac{5}{30}=9\frac{1}{6} \end{array}$$

22.
$$\begin{array}{r} 11\frac{4}{9}=11\frac{8}{18} \\ +7\frac{1}{6}=7\frac{3}{18} \\ \hline 18\frac{11}{18} \end{array}$$

23.
$$\begin{array}{r} 7\frac{6}{7}=7\frac{12}{14} \\ -1\frac{1}{2}=1\frac{7}{14} \\ \hline 6\frac{5}{14} \end{array}$$

24.
$$\begin{array}{r} 3\frac{13}{28}=3\frac{26}{56} \\ -1\frac{1}{8}=1\frac{7}{56} \\ \hline 2\frac{19}{56} \end{array}$$

25.
$$\begin{array}{r} 5\frac{8}{9}=5\frac{16}{18} \\ +7\frac{5}{6}=7\frac{15}{18} \\ \hline 12\frac{31}{18}=13\frac{13}{18} \end{array}$$

26.
$$\begin{array}{r} 9\frac{3}{4}=9\frac{15}{20} \\ +7\frac{3}{10}=7\frac{6}{20} \\ \hline 16\frac{21}{20}=17\frac{1}{20} \end{array}$$

27.
$$\begin{array}{r} 9\ \ =8\frac{4}{4} \\ -5\frac{3}{4}=5\frac{3}{4} \\ \hline 3\frac{1}{4} \end{array}$$

28.
$$\begin{array}{r} 8\frac{1}{4}=8\frac{3}{12}=7\frac{15}{12} \\ -5\frac{5}{6}=5\frac{10}{12}=5\frac{10}{12} \\ \hline 2\frac{5}{12} \end{array}$$

Section 2.6

Concept Check

1. $\frac{5}{9}\times\frac{2}{3}=\frac{5\cdot 2}{9\cdot 3}=\frac{10}{27}$

3. Yes

Objective A Exercises

5. $\frac{2}{3}\times\frac{7}{8}=\frac{2\cdot 7}{3\cdot 8}=\frac{\overset{1}{\cancel{2}}\cdot 7}{3\cdot\underset{1}{\cancel{2}}\cdot 2\cdot 2}=\frac{7}{12}$

7. $\frac{5}{16}\times\frac{7}{15}=\frac{5\cdot 7}{16\cdot 15}=\frac{\overset{1}{\cancel{5}}\cdot 7}{2\cdot 2\cdot 2\cdot 2\cdot 3\cdot\underset{1}{\cancel{5}}}=\frac{7}{48}$

9. $\frac{1}{6}\times\frac{1}{8}=\frac{1\cdot 1}{6\cdot 8}=\frac{1\cdot 1}{2\cdot 3\cdot 2\cdot 2\cdot 2}=\frac{1}{48}$

11. $\frac{11}{12}\times\frac{6}{7}=\frac{11\cdot 6}{12\cdot 7}=\frac{11\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}}\cdot 2\cdot\underset{1}{\cancel{3}}\cdot 7}=\frac{11}{14}$

13. $\frac{8}{9}\times\frac{27}{4}=\frac{8\cdot 27}{9\cdot 4}=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 2\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot 3}{\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}}=6$

15. $\frac{5}{6}\times\frac{1}{2}=\frac{5\cdot 1}{6\cdot 2}=\frac{5\cdot 1}{2\cdot 3\cdot 2}=\frac{5}{12}$

17. $\frac{16}{9}\times\frac{27}{8}=\frac{16\cdot 27}{9\cdot 8}=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 2\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot 3}{\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}}=6$

19. $\frac{3}{2}\times\frac{4}{9}=\frac{3\cdot 4}{2\cdot 9}=\frac{\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{2}}\cdot 2}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{3}}\cdot 3}=\frac{2}{3}$

21. $\frac{7}{8}\times\frac{3}{14}=\frac{7\cdot 3}{8\cdot 14}=\frac{\overset{1}{\cancel{7}}\cdot 3}{2\cdot 2\cdot 2\cdot 2\cdot\underset{1}{\cancel{7}}}=\frac{3}{16}$

23. $\frac{7}{10}\times\frac{3}{8}=\frac{7\cdot 3}{10\cdot 8}=\frac{7\cdot 3}{2\cdot 5\cdot 2\cdot 2\cdot 2}=\frac{21}{80}$

25. $\frac{15}{8}\times\frac{16}{3}=\frac{15\cdot 16}{8\cdot 3}=\frac{\overset{1}{\cancel{3}}\cdot 5\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 2}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{3}}}=10$

27. $\frac{1}{2}\times\frac{2}{15}=\frac{1\cdot 2}{2\cdot 15}=\frac{1\cdot\overset{1}{\cancel{2}}}{\underset{1}{\cancel{2}}\cdot 3\cdot 5}=\frac{1}{15}$

29. $\frac{5}{7}\times\frac{14}{15}=\frac{5\cdot 14}{7\cdot 15}=\frac{\overset{1}{\cancel{5}}\cdot 2\cdot\overset{1}{\cancel{7}}}{\underset{1}{\cancel{7}}\cdot 3\cdot\underset{1}{\cancel{5}}}=\frac{2}{3}$

31. $\frac{5}{12}\times\frac{42}{65}=\frac{5\cdot 42}{12\cdot 65}=\frac{\overset{1}{\cancel{5}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{3}}\cdot 7}{\underset{1}{\cancel{2}}\cdot 2\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{5}}\cdot 13}=\frac{7}{26}$

33. $\frac{12}{5}\times\frac{5}{3}=\frac{12\cdot 5}{5\cdot 3}=\frac{2\cdot 2\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}}\cdot\underset{1}{\cancel{3}}}=4$

35. $\frac{10}{21}\times\frac{14}{15}=\frac{10\cdot 14}{21\cdot 15}=\frac{2\cdot\overset{1}{\cancel{5}}\cdot 2\cdot\overset{1}{\cancel{7}}}{3\cdot\underset{1}{\cancel{7}}\cdot 3\cdot\underset{1}{\cancel{5}}}=\frac{4}{9}$

37. Answers will vary. For example, $\frac{3}{4}$ and $\frac{4}{3}$

39. $\frac{32}{9}\times\frac{3}{8}=\frac{32\cdot 3}{9\cdot 8}=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 2\cdot 2\cdot\overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}}\cdot 3\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}}=\frac{4}{3}=1\frac{1}{3}$

41. $\frac{7}{3}\times\frac{15}{14}=\frac{7\cdot 15}{3\cdot 14}=\frac{\overset{1}{\cancel{7}}\cdot\overset{1}{\cancel{3}}\cdot 5}{\underset{1}{\cancel{3}}\cdot 2\cdot\underset{1}{\cancel{7}}}=\frac{5}{2}=2\frac{1}{2}$

43. $\frac{3}{8}\times\frac{12}{17}=\frac{3\cdot 12}{8\cdot 17}=\frac{3\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 3}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot 2\cdot 17}=\frac{9}{34}$

Objective B Exercises

45. $14\times\frac{5}{7}=\frac{14\cdot 5}{1\cdot 7}=\frac{2\cdot\overset{1}{\cancel{7}}\cdot 5}{1\cdot\underset{1}{\cancel{7}}}=10$

47. $\frac{5}{12}\times 40=\frac{5\cdot 40}{12\cdot 1}=\frac{5\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 2\cdot 5}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot 3\cdot 1}=\frac{50}{3}=16\frac{2}{3}$

49. $\frac{2}{5}\times 2\frac{1}{2}=\frac{2}{5}\times\frac{5}{2}=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}}\cdot\underset{1}{\cancel{2}}}=1$

51. $2\frac{1}{5}\times\frac{5}{22}=\frac{11}{5}\times\frac{5}{22}=\frac{\overset{1}{\cancel{11}}\cdot\overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}}\cdot 2\cdot\underset{1}{\cancel{11}}}=\frac{1}{2}$

53. $9\times 3\frac{1}{3}=\frac{9}{1}\times\frac{10}{3}=\frac{\overset{1}{\cancel{3}}\cdot 3\cdot 2\cdot 5}{1\cdot\underset{1}{\cancel{3}}}=30$

55. $5\frac{1}{4}\times 8=\frac{21}{4}\times\frac{8}{1}=\frac{3\cdot 7\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot 2}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot 1}=42$

57. $4\frac{2}{9}\times 3=\frac{38}{9}\times\frac{3}{1}=\frac{2\cdot 19\cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}}\cdot 3\cdot 1}=\frac{38}{3}=12\frac{2}{3}$

59. $\frac{3}{8}\times 4\frac{4}{5}=\frac{3}{8}\times\frac{24}{5}=\frac{3\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot 3}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot 5}=\frac{9}{5}=1\frac{4}{5}$

61. $5\frac{1}{3}\times\frac{5}{16}=\frac{16}{3}\times\frac{5}{16}=\frac{\overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot 5}{3\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}}=\frac{5}{3}=1\frac{2}{3}$

63. $\frac{5}{7}\times 2\frac{1}{3}=\frac{5}{7}\times\frac{7}{3}=\frac{5\cdot \overset{1}{\cancel{7}}}{\underset{1}{\cancel{7}}\cdot 3}=\frac{5}{3}=1\frac{2}{3}$

65. $6\frac{1}{8}\times 0=\frac{49}{8}\times 0=\frac{49\cdot 0}{8}=0$

67. $5\frac{3}{16}\times 5\frac{1}{3}=\frac{83}{16}\times\frac{16}{3}$

$$=\frac{83\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot 3}=\frac{83}{3}=27\frac{2}{3}$$

69. $3\frac{3}{4}\times 2\frac{3}{20}=\frac{15}{4}\times\frac{43}{20}$

$$=\frac{3\cdot \overset{1}{\cancel{5}}\cdot 43}{2\cdot 2\cdot 2\cdot 2\cdot \underset{1}{\cancel{5}}}$$

$$=\frac{129}{16}=8\frac{1}{16}$$

71. $6\frac{1}{2}\times 1\frac{3}{13}=\frac{13}{2}\times\frac{16}{13}=\frac{\overset{1}{\cancel{13}}\cdot \overset{1}{\cancel{2}}\cdot 2\cdot 2\cdot 2}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{13}}}=8$

73. $4\times 13\frac{1}{2}=\frac{4}{1}\times\frac{27}{2}=\frac{\overset{1}{\cancel{2}}\cdot 2\cdot 3\cdot 3\cdot 3}{\underset{1}{\cancel{2}}}=54$

The distance is 54 feet.

75. $2\frac{1}{2}\times 3\frac{3}{5}=\frac{5}{2}\times\frac{18}{5}=\frac{\overset{1}{\cancel{5}}\cdot \overset{1}{\cancel{2}}\cdot 3\cdot 3}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{5}}}=9$

77. $2\frac{1}{8}\times\frac{5}{17}=\frac{17}{8}\times\frac{5}{17}=\frac{\overset{1}{\cancel{17}}\cdot 5}{2\cdot 2\cdot 2\cdot \underset{1}{\cancel{17}}}=\frac{5}{8}$

79. $1\frac{3}{8}\times 2\frac{1}{5}=\frac{11}{8}\times\frac{11}{5}=\frac{121}{40}=3\frac{1}{40}$

Objective C Exercises

81. Less than \$12, because $2\frac{3}{4}<3$

83. **Strategy** To find the cost of the salmon, multiply the amount of salmon $\left(2\frac{3}{4}\text{ pounds}\right)$ by the cost per pound (\$4).

Solution $2\frac{3}{4}\times 4=\frac{11}{4}\times\frac{4}{1}=\frac{11\cdot 4}{4\cdot 1}=11$

The salmon costs \$11.

85. **Strategy** To find the length cut, multiply the length of the board $\left(9\frac{1}{4}\text{ feet}\right)$ by $\frac{1}{3}$.

Solution $\frac{1}{3}\times 9\frac{1}{4}=\frac{1}{3}\times\frac{37}{4}$

$$=\frac{1\cdot 37}{3\cdot 4}$$

$$=\frac{37}{12}=3\frac{1}{12}$$

The length of the board cut off is $3\frac{1}{12}$ feet.

87. **Strategy** To find the area of the square, multiply the length of one side $\left(5\frac{1}{4}\text{ feet}\right)$ by itself $\left(5\frac{1}{4}\text{ feet}\right)$.

Solution

$$5\frac{1}{4}\times 5\frac{1}{4}=\frac{21}{4}\times\frac{21}{4}$$
$$=\frac{21\cdot 21}{4\cdot 4}$$
$$=\frac{441}{16}=27\frac{9}{16}$$

The area of the square is $27\frac{9}{16}$ square feet.

89. Strategy To find the number of acres turned into ethanol, multiply the total number of acres planted each year (90 million) by $\frac{2}{5}$.

Solution

$$90\times\frac{2}{5}=\frac{90}{1}\times\frac{2}{5}=\frac{90\cdot 2}{1\cdot 5}$$
$$=\frac{180}{5}=36$$

36 million acres of corn are turned into ethanol each year.

91. $12\frac{7}{12}\times 4\frac{1}{3}=\frac{151}{12}\times\frac{13}{3}=\frac{1963}{36}=54\frac{19}{36}$

The weight of the $12\frac{7}{12}$-foot steel rod is $54\frac{19}{36}$ pounds.

93. Strategy To find the total cost of the capes, multiply the amount of material each cape requires $\left(1\frac{3}{8}\text{ yards}\right)$ by the cost of 1 yard ($12) and by the number of capes needed (22).

Solution

$$1\frac{3}{8}\times 12\times 22=\frac{11}{8}\times 12\times 22$$
$$=\frac{11\times 12\times 22}{8}$$
$$=363$$

The total cost is $363.

Critical Thinking

95. $\frac{1}{2}$; Any number multiplied by 1 is the number.

97. *A*. The product of any two positive rational numbers, each less than 1, is less than either of the two numbers.

Section 2.7

Concept Check

1. $\frac{7}{3}$

3. $\frac{5}{4}$

5. $\frac{3}{8}\div\frac{4}{9}=\frac{3}{8}\times\frac{9}{4}=\frac{27}{32}$

Objective A Exercises

7. $\frac{1}{3}\div\frac{2}{5}=\frac{1}{3}\times\frac{5}{2}=\frac{1\cdot 5}{3\cdot 2}=\frac{5}{6}$

9. $\frac{3}{7}\div\frac{3}{7}=\frac{3}{7}\times\frac{7}{3}=\frac{\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{7}}}{\underset{1}{\cancel{7}}\cdot\underset{1}{\cancel{3}}}=1$

11. $0\div\frac{3}{4}=0\times\frac{4}{3}=0$

13. $\frac{5}{24}\div\frac{15}{36}=\frac{5}{24}\times\frac{36}{15}=\frac{\overset{1}{\cancel{5}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot 2\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{5}}}=\frac{1}{2}$

15. $\frac{1}{9}\div\frac{2}{3}=\frac{1}{9}\times\frac{3}{2}=\frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}}\cdot 3\cdot 2}=\frac{1}{6}$

17. $\frac{2}{5}\div\frac{4}{7}=\frac{2}{5}\times\frac{7}{4}=\frac{\overset{1}{\cancel{2}}\cdot 7}{5\cdot\underset{1}{\cancel{2}}\cdot 2}=\frac{7}{10}$

19. $\frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times \frac{4}{1} = \frac{\overset{1}{2} \cdot 2}{\underset{1}{2}} = 2$

21. $\frac{1}{5} \div \frac{1}{10} = \frac{1}{5} \times \frac{10}{1} = \frac{2 \cdot \overset{1}{5}}{\underset{1}{5}} = 2$

23. $\frac{7}{15} \div \frac{14}{5} = \frac{7}{15} \times \frac{5}{14} = \frac{\overset{1}{7} \cdot \overset{1}{5}}{3 \cdot \underset{1}{5} \cdot 2 \cdot \underset{1}{7}} = \frac{1}{6}$

25. $\frac{14}{3} \div \frac{7}{9} = \frac{14}{3} \times \frac{9}{7} = \frac{2 \cdot \overset{1}{7} \cdot \overset{1}{3} \cdot 3}{\underset{1}{3} \cdot \underset{1}{7}} = 6$

27. $\frac{5}{9} \div \frac{25}{3} = \frac{5}{9} \times \frac{3}{25} = \frac{\overset{1}{5} \cdot \overset{1}{3}}{\underset{1}{3} \cdot 3 \cdot \underset{1}{5} \cdot 5} = \frac{1}{15}$

29. $\frac{2}{3} \div \frac{1}{3} = \frac{2}{3} \times \frac{3}{1} = \frac{2 \cdot \overset{1}{3}}{\underset{1}{3}} = 2$

31. $\frac{5}{7} \div \frac{2}{7} = \frac{5}{7} \times \frac{7}{2} = \frac{5 \cdot \overset{1}{7}}{\underset{1}{7} \cdot 2} = \frac{5}{2} = 2\frac{1}{2}$

33. $\frac{2}{3} \div \frac{2}{9} = \frac{2}{3} \times \frac{9}{2} = \frac{\overset{1}{2} \cdot \overset{1}{3} \cdot 3}{\underset{1}{3} \cdot \underset{1}{2}} = 3$

35. $\frac{7}{8} \div \frac{3}{4} = \frac{7}{8} \times \frac{4}{3} = \frac{7 \cdot \overset{1}{2} \cdot \overset{1}{2}}{\underset{1}{2} \cdot \underset{1}{2} \cdot 2 \cdot 3} = \frac{7}{6} = 1\frac{1}{6}$

37. $\frac{5}{7} \div \frac{3}{14} = \frac{5}{7} \times \frac{14}{3} = \frac{5 \cdot 2 \cdot \overset{1}{7}}{\underset{1}{7} \cdot 3} = \frac{10}{3} = 3\frac{1}{3}$

39. True

Objective B Exercises

41. $4 \div \frac{2}{3} = \frac{4}{1} \times \frac{3}{2} = \frac{\overset{1}{2} \cdot 2 \cdot 3}{\underset{1}{2}} = 6$

43. $\frac{3}{2} \div 3 = \frac{3}{2} \times \frac{1}{3} = \frac{\overset{1}{3}}{2 \cdot \underset{1}{3}} = \frac{1}{2}$

45. $\frac{5}{6} \div 25 = \frac{5}{6} \times \frac{1}{25} = \frac{\overset{1}{5}}{2 \cdot 3 \cdot \underset{1}{5} \cdot 5} = \frac{1}{30}$

47. $6 \div 3\frac{1}{3} = \frac{6}{1} \div \frac{10}{3} = \frac{6}{1} \times \frac{3}{10} = \frac{\overset{1}{2} \cdot 3 \cdot 3}{\underset{1}{2} \cdot 5} = \frac{9}{5} = 1\frac{4}{5}$

49. $6\frac{1}{2} \div \frac{1}{2} = \frac{13}{2} \div \frac{1}{2} = \frac{13}{2} \times \frac{2}{1} = \frac{13 \cdot \overset{1}{2}}{\underset{1}{2}} = 13$

51.

$$8\frac{1}{4} \div 2\frac{3}{4} = \frac{33}{4} \div \frac{11}{4} = \frac{33}{4} \times \frac{4}{11} = \frac{3 \cdot \overset{1}{11} \cdot \overset{1}{2} \cdot \overset{1}{2}}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{11}} = 3$$

53. $4\frac{1}{5} \div 21 = \frac{21}{5} \div \frac{21}{1} = \frac{21}{5} \times \frac{1}{21} = \frac{\overset{1}{3} \cdot \overset{1}{7}}{5 \cdot \underset{1}{3} \cdot \underset{1}{7}} = \frac{1}{5}$

55.

$$\frac{11}{12} \div 2\frac{1}{3} = \frac{11}{12} \div \frac{7}{3} = \frac{11}{12} \times \frac{3}{7} = \frac{11 \cdot \overset{1}{3}}{2 \cdot 2 \cdot \underset{1}{3} \cdot 7} = \frac{11}{28}$$

57. $35 \div \frac{7}{24} = \frac{35}{1} \times \frac{24}{7} = \frac{5 \cdot \overset{1}{7} \cdot 2 \cdot 2 \cdot 2 \cdot 3}{\underset{1}{7}} = 120$

59.
$$\frac{11}{18} \div 2\frac{2}{9} = \frac{11}{18} \div \frac{20}{9} = \frac{11}{18} \times \frac{9}{20}$$
$$= \frac{11 \cdot \overset{1}{3} \cdot \overset{1}{3}}{2 \cdot \underset{1}{3} \cdot \underset{1}{3} \cdot 2 \cdot 2 \cdot 5} = \frac{11}{40}$$

61.
$$2\frac{1}{16} \div 2\frac{1}{2} = \frac{33}{16} \div \frac{5}{2} = \frac{33}{16} \times \frac{2}{5}$$
$$= \frac{3 \cdot 11 \cdot \overset{1}{2}}{\underset{1}{2} \cdot 2 \cdot 2 \cdot 2 \cdot 5} = \frac{33}{40}$$

63.
$$1\frac{2}{3} \div \frac{3}{8} = \frac{5}{3} \div \frac{3}{8} = \frac{5}{3} \times \frac{8}{3}$$
$$= \frac{5 \cdot 2 \cdot 2 \cdot 2}{3 \cdot 3}$$
$$= \frac{40}{9} = 4\frac{4}{9}$$

65. $1\frac{5}{8} \div 4 = \frac{13}{8} \div \frac{4}{1} = \frac{13}{8} \times \frac{1}{4}$

$$= \frac{13}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2} = \frac{13}{32}$$

67. $16 \div 1\frac{1}{2} = 16 \div \frac{3}{2} = \frac{16}{1} \times \frac{2}{3}$

$$= \frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{3}$$

$$= \frac{32}{3} = 10\frac{2}{3}$$

69. $1\frac{1}{3} \div 5\frac{8}{9} = \frac{4}{3} \div \frac{53}{9} = \frac{4}{3} \times \frac{9}{53}$

$$= \frac{2 \cdot 2 \cdot \overset{1}{\cancel{3}} \cdot 3}{\underset{1}{\cancel{3}} \cdot 53} = \frac{12}{53}$$

71. $82\frac{3}{5} \div 19\frac{1}{10} = \frac{413}{5} \div \frac{191}{10} = \frac{413}{5} \times \frac{10}{191}$

$$= \frac{7 \cdot 59 \cdot 2 \cdot \overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}} \cdot 191} = \frac{826}{191} = 4\frac{62}{191}$$

73. $102 \div 1\frac{1}{2} = \frac{102}{1} \div \frac{3}{2} = \frac{102}{1} \times \frac{2}{3}$

$$= \frac{2 \cdot \overset{1}{\cancel{3}} \cdot 17 \cdot 2}{\underset{1}{\cancel{3}}} = 68$$

75. $8\frac{2}{7} \div 1 = \frac{58}{7} \div 1 = \frac{58}{7} \times 1 = \frac{58}{7} = 8\frac{2}{7}$

77. $8\frac{8}{9} \div 2\frac{13}{18} = \frac{80}{9} \div \frac{49}{18} = \frac{80}{9} \times \frac{18}{49}$

$$= \frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 2 \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot 7 \cdot 7}$$

$$= \frac{160}{49} = 3\frac{13}{49}$$

79. $7\frac{3}{8} \div 1\frac{27}{32} = \frac{59}{8} \div \frac{59}{32} = \frac{59}{8} \times \frac{32}{59}$

$$= \frac{\overset{1}{\cancel{59}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot 2 \cdot 2}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{59}}} = 4$$

81. $2\frac{3}{4} \div 1\frac{23}{32} = \frac{11}{4} \div \frac{55}{32} = \frac{11}{4} \times \frac{32}{35}$

$$= \frac{\overset{1}{\cancel{11}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot 2 \cdot 2}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 5 \cdot \underset{1}{\cancel{11}}} = \frac{8}{5} = 1\frac{3}{5}$$

83. $\frac{14}{77} \div 3\frac{1}{9} = \frac{14}{77} \div \frac{28}{9} = \frac{14}{17} \times \frac{9}{28}$

$$= \frac{\overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{7}} \cdot 3 \cdot 3}{17 \cdot \underset{1}{\cancel{2}} \cdot 2 \cdot \underset{1}{\cancel{7}}} = \frac{9}{34}$$

85. False

Objective C Exercises

87. Less than 16, because $1\frac{1}{3} > 1$

89. **Strategy** To find the number of servings in 16 ounces of cereal, divide 16 by the amount in each serving $\left(1\frac{1}{3} \text{ ounces}\right)$.

Solution

$$16 \div 1\frac{1}{3} = 16 \div \frac{4}{3}$$

$$= 16 \times \frac{3}{4} = \frac{16 \cdot 3}{4}$$

$$= 12$$

There are 12 servings in 16 ounces of cereal.

91. **Strategy** To find the cost of each acre, divide the total cost ($200,000) by the number of acres $\left(8\frac{1}{3}\right)$.

Solution

$$200{,}000 \div 8\frac{1}{3} = 200{,}000 \div \frac{25}{3}$$

$$= 200{,}000 \times \frac{3}{25}$$

$$= \frac{200{,}000 \cdot 3}{25}$$

$$= 24{,}000$$

Each acre costs $24,000.

93. **Strategy** To find the number of turns, divide the distance for the nut to move $\left(1\frac{7}{8} \text{ inches}\right)$ by the distance the nut moves for each turn $\left(\frac{5}{32} \text{ inch}\right)$.

Solution

$$1\frac{7}{8} \div \frac{5}{32} = \frac{15}{8} \div \frac{5}{32}$$
$$= \frac{15}{8} \times \frac{32}{5}$$
$$= \frac{3 \cdot \cancel{5}^{1} \cdot \cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{2}^{1} \cdot 2 \cdot 2}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{\cancel{5}}}$$
$$= 12$$

The nut will make 12 turns in moving $1\frac{7}{8}$ inches .

95a. **Strategy** To find the total weight of the fat and bone, subtract the weight after trimming $\left(9\frac{1}{3} \text{ pounds}\right)$ from the original weight $\left(10\frac{3}{4} \text{ pounds}\right)$.

Solution

$$10\frac{3}{4} = 10\frac{9}{12}$$
$$-9\frac{1}{3} = \quad 9\frac{4}{12}$$
$$1\frac{5}{12}$$

The total weight of the fat and bone was $1\frac{5}{12}$ pounds.

b. **Strategy** To find the number of servings, divide the weight after trimming $\left(9\frac{1}{3} \text{ pounds}\right)$ by the weight of one serving $\left(\frac{1}{3} \text{ pound}\right)$.

Solution

$$9\frac{1}{3} \div \frac{1}{3} = \frac{28}{3} \div \frac{1}{3} = \frac{28}{3} \times \frac{3}{1}$$
$$= \frac{28 \cdot \cancel{3}^{1}}{\underset{1}{\cancel{3}} \cdot 1} = 28$$

The chef can cut 28 servings from the roast.

97. **Strategy** To find the distance between each post:

- Find the total distance taken up by the five posts $\left(1\frac{1}{4} \text{ inches each}\right)$.
- Subtract that sum from the total distance between the posts $\left(22\frac{3}{4} \text{ inches}\right)$.
- Divide the remaining distance by six, the number of spaces between each of the five inserted posts and the end posts.

Solution

$$5 \times 1\frac{1}{4} = \frac{5}{1} \times \frac{5}{4} = \frac{5 \cdot 5}{1 \cdot 4} = \frac{25}{4}$$
$$22\frac{3}{4} - \frac{25}{4} = \frac{91}{4} - \frac{25}{4} = \frac{66}{4}$$
$$\frac{66}{4} \div 6 = \frac{66}{4} \times \frac{1}{6} = \frac{\cancel{66}^{11} \cdot 1}{4 \cdot \cancel{6}_{1}}$$
$$= \frac{11}{4} = 2\frac{3}{4}$$

The distance between each post is $2\frac{3}{4}$ inches.

Critical Thinking

99. $\frac{2}{3} - \boxed{\frac{1}{2}} = \frac{4}{6} - \frac{3}{6} = \frac{1}{6}$

101. $\boxed{\frac{1}{2}}+\frac{3}{5}=\frac{5}{10}+\frac{6}{10}=\frac{11}{10}=1\frac{1}{10}$

103. $\frac{3}{4}\cdot\boxed{\frac{2}{3}}=\frac{6}{12}=\frac{1}{2}$

105. $\boxed{\frac{2}{3}}\div\frac{3}{4}=\frac{2}{3}\cdot\frac{4}{3}=\frac{8}{9}$

107. **Strategy** To find the bank-recommended maximum monthly house payment, multiply your monthly income ($4500) by $\frac{1}{3}$.

Solution $4500\times\frac{1}{3}=\frac{4500}{3}=1500$

The bank would recommend that your maximum monthly house payment be $1500.

109. **Strategy** To find the dimensions of the game board when it is closed, multiply the length of one side (14 inches) by $\frac{1}{2}$ and multiply the thickness $\left(\frac{7}{8}\text{ inch}\right)$ 2.

Solution $\frac{1}{2}\times 14=7$ inches on one side

The thickness is

$2\times\frac{7}{8}=\frac{7}{4}=1\frac{3}{4}$ inches.

The other dimension (14 inches) remains the same.

The dimensions of the board when it is closed are 14 inches by 7 inches by $1\frac{3}{4}$ inches.

111. First, find the spacing between the three columns.

$\frac{3}{8}\times 2=\frac{3}{8}\times\frac{2}{1}=\frac{3}{4}$ inch

Second, find the remaining space for the columns.

$7\frac{1}{2}-\frac{3}{4}=7\frac{2}{4}-\frac{3}{4}=6\frac{6}{4}-\frac{3}{4}=6\frac{3}{4}$ inches

Third, divide that space among the three columns.

$6\frac{3}{4}\div 3=\frac{27}{4}\times\frac{1}{3}=\frac{9}{4}=2\frac{1}{4}$ inches

Projects or Group Activities

113. Safari: $\frac{3}{50}$

Opera: $\frac{1}{50}$

$\frac{3}{50}\div\frac{1}{50}=\frac{3}{\cancel{50}_{1}}\cdot\frac{\overset{1}{\cancel{50}}}{1}=3$

3 times more people

115. $\frac{9}{50}+\frac{3}{50}+\frac{1}{50}+\frac{7}{25}+\frac{9}{25}$

$=\frac{9}{50}+\frac{3}{50}+\frac{1}{50}+\frac{14}{50}+\frac{18}{50}=\frac{45}{50}$

$1-\frac{45}{50}=\frac{50}{50}-\frac{45}{50}=\frac{5}{50}=\frac{1}{10}$

Section 2.8

Concept Check

1. Equal to

3. Less than

Objective A Exercises

5. $\frac{11}{40} < \frac{19}{40}$

7. $\frac{2}{3} = \frac{14}{21}, \frac{5}{7} = \frac{15}{21}, \frac{2}{3} < \frac{5}{7}$

9. $\frac{5}{8} = \frac{15}{24}, \frac{7}{12} = \frac{14}{24}, \frac{5}{8} > \frac{7}{12}$

11. $\frac{7}{9} = \frac{28}{36}, \frac{11}{12} = \frac{33}{36}, \frac{7}{9} < \frac{11}{12}$

13. $\frac{13}{14} = \frac{39}{42}, \frac{19}{21} = \frac{38}{42}, \frac{13}{14} > \frac{19}{21}$

15. $\frac{7}{24} = \frac{35}{120}, \frac{11}{30} = \frac{44}{120}, \frac{7}{24} < \frac{11}{30}$

17. $\frac{4}{5}$ is larger.

Objective B Exercises

19. $\left(\frac{5}{12}\right)^2 = \frac{5}{12} \cdot \frac{5}{12} = \frac{25}{144}$

21. $\left(\frac{1}{2}\right) \cdot \left(\frac{2}{3}\right)^2 = \left(\frac{1}{2}\right) \cdot \left(\frac{2}{3} \cdot \frac{2}{3}\right) = \frac{\overset{1}{\cancel{2}} \cdot 2}{\underset{1}{\cancel{2}} \cdot 3 \cdot 3} = \frac{2}{9}$

23. $\left(\frac{1}{3}\right)^2 \cdot \left(\frac{3}{5}\right)^3 = \left(\frac{1}{3} \cdot \frac{1}{3}\right) \cdot \left(\frac{3}{5} \cdot \frac{3}{5} \cdot \frac{3}{5}\right)$

$= \frac{1 \cdot 1 \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}} \cdot 3}{\underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot 5 \cdot 5 \cdot 5} = \frac{3}{125}$

25. $\left(\frac{5}{9}\right)^3 \cdot \left(\frac{18}{25}\right)^2 = \left(\frac{5}{9} \cdot \frac{5}{9} \cdot \frac{5}{9}\right) \cdot \left(\frac{18}{25} \cdot \frac{18}{25}\right)$

$= \frac{\overset{1}{\cancel{5}} \cdot \overset{1}{\cancel{5}} \cdot \overset{1}{\cancel{5}} \cdot 2 \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}} \cdot 2 \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot 3 \cdot 3 \cdot \underset{1}{\cancel{5}} \cdot \underset{1}{\cancel{5}} \cdot \underset{1}{\cancel{5}} \cdot 5} = \frac{4}{45}$

27. $\frac{2}{5} + \frac{3}{10} - \frac{2}{3} = \frac{4}{10} + \frac{3}{10} - \frac{2}{3}$

$= \frac{7}{10} - \frac{2}{3}$

$= \frac{21}{30} - \frac{20}{30}$

$= \frac{1}{30}$

29. $\frac{3}{7} \cdot \frac{14}{15} + \frac{4}{5} = \frac{2}{5} + \frac{4}{5}$

$= \frac{6}{5} = 1\frac{1}{5}$

31. $\frac{5}{8} + \frac{1}{8} \cdot \frac{2}{3} = \frac{5}{8} + \frac{2}{24}$

$= \frac{15}{24} + \frac{2}{24}$

$= \frac{17}{24}$

33. $\frac{5}{6} \div \frac{2}{3} - \frac{3}{4} \cdot \frac{1}{2} = \frac{5}{\underset{2}{\cancel{6}}} \cdot \frac{\overset{1}{\cancel{3}}}{2} - \frac{3}{4} \cdot \frac{1}{2}$

$= \frac{5}{4} - \frac{3}{8}$

$= \frac{10}{8} - \frac{3}{8}$

$= \frac{7}{8}$

35. $\frac{7}{8}-\frac{2}{3}\cdot\frac{1}{2}+\frac{5}{6}=\frac{7}{8}-\frac{\cancel{2}^{1}}{3}\cdot\frac{1}{\cancel{2}_{1}}+\frac{5}{6}$

$=\frac{7}{8}-\frac{1}{3}+\frac{5}{6}$

$=\frac{21}{24}-\frac{8}{24}+\frac{20}{24}$

$=\frac{33}{24}$

$=1\frac{9}{24}$

$=1\frac{3}{8}$

37. $\frac{5}{6}+\frac{1}{2}\div\frac{3}{4}-\frac{5}{8}=\frac{5}{6}+\frac{1}{\cancel{2}_{1}}\cdot\frac{\cancel{4}^{2}}{3}-\frac{5}{8}$

$=\frac{5}{6}+\frac{2}{3}-\frac{5}{8}$

$=\frac{20}{24}+\frac{16}{24}-\frac{15}{24}$

$=\frac{21}{24}$

$=\frac{7}{8}$

39. $\left(\frac{3}{5}\right)^3-\frac{3}{25}=\frac{27}{125}-\frac{3}{25}$

$=\frac{27}{125}-\frac{15}{125}$

$=\frac{12}{125}$

41. $\frac{3}{4}\cdot\left(\frac{11}{12}-\frac{7}{8}\right)+\frac{5}{16}=\frac{3}{4}\cdot\left(\frac{22}{24}-\frac{21}{24}\right)+\frac{5}{16}$

$=\frac{3}{4}\cdot\frac{1}{24}+\frac{5}{16}$

$=\frac{1}{32}+\frac{5}{16}$

$=\frac{1}{32}+\frac{10}{32}$

$=\frac{11}{32}$

43. $\frac{11}{16}-\left(\frac{3}{4}\right)^2+\frac{7}{12}=\frac{11}{16}-\frac{9}{16}+\frac{7}{12}$

$=\frac{2}{16}+\frac{7}{12}$

$=\frac{1}{8}+\frac{7}{12}$

$=\frac{3}{24}+\frac{14}{24}$

$=\frac{17}{24}$

45. $\frac{9}{10}\cdot\left(\frac{2}{3}\right)^3+\frac{2}{3}=\frac{9}{10}\cdot\frac{8}{27}+\frac{2}{3}$

$=\frac{4}{15}+\frac{2}{3}$

$=\frac{4}{15}+\frac{10}{15}$

$=\frac{14}{15}$

47. $\left(\frac{2}{3}+\frac{5}{6}\right)\div\frac{5}{9}=\left(\frac{4}{6}+\frac{5}{6}\right)\div\frac{5}{9}$

$=\frac{9}{6}\cdot\frac{9}{5}$

$=\frac{27}{10}$

$=2\frac{7}{10}$

49. $\frac{7}{12}\div\left(\frac{2}{3}+\frac{5}{9}\right)=\frac{7}{12}\div\left(\frac{6}{9}+\frac{5}{9}\right)$

$=\frac{7}{12}\div\frac{11}{9}$

$=\frac{7}{12}\cdot\frac{9}{11}$

$=\frac{21}{44}$

51. $\left(\frac{5}{6}\right)^2\div\left(\frac{5}{12}+\frac{2}{3}\right)=\left(\frac{5}{6}\right)^2\div\left(\frac{5}{12}+\frac{8}{12}\right)$

$=\left(\frac{5}{6}\right)^2\div\frac{13}{12}$

$=\frac{25}{36}\cdot\frac{12}{13}$

$=\frac{25}{39}$

53. $\left(\frac{1}{6}+\frac{1}{2}\right)^2+\frac{2}{3}=\left(\frac{1}{6}+\frac{3}{6}\right)^2+\frac{2}{3}$

$$=\left(\frac{4}{6}\right)^2+\frac{2}{3}$$
$$=\left(\frac{2}{3}\right)^2+\frac{2}{3}$$
$$=\frac{4}{9}+\frac{6}{9}$$
$$=\frac{10}{9}$$
$$=1\frac{1}{9}$$

55. $\frac{5}{6}+\left(\frac{3}{4}-\frac{1}{2}\right)^2=\frac{5}{6}+\left(\frac{3}{4}-\frac{2}{4}\right)^2$

$$=\frac{5}{6}+\left(\frac{1}{4}\right)^2$$
$$=\frac{5}{6}+\frac{1}{16}$$
$$=\frac{40}{48}+\frac{3}{48}$$
$$=\frac{43}{48}$$

Applying the Concepts

57a. $\frac{13}{50}=\frac{26}{100}$ Location

$\frac{1}{4}=\frac{25}{100}$ Food Quality

More people choose location.

b. $\frac{1}{4}=\frac{25}{100}$ Food Quality

$\frac{13}{50}=\frac{26}{100}$ Location

$\frac{4}{25}=\frac{16}{100}$ Menu

$\frac{2}{25}=\frac{8}{100}$ Price

$\frac{3}{25}=\frac{12}{100}$ Speed

$\frac{3}{100}=\frac{3}{100}$ Other

The criterion that was cited by most people was location.

Projects or Group Activities

59. $\left(\frac{7}{8}+\frac{2}{3}\right)\frac{1}{2}+\frac{5}{6}=\left(\frac{21}{24}+\frac{16}{24}\right)\frac{1}{2}+\frac{5}{6}$

$$=\left(\frac{37}{24}\right)\frac{1}{2}+\frac{5}{6}$$
$$=\frac{37}{48}+\frac{5}{6}$$
$$=\frac{37}{48}+\frac{40}{48}$$
$$=\frac{77}{48}$$
$$=1\frac{29}{48}$$

Chapter 2 Review Exercises

1. $\frac{30}{45}=\frac{2\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{5}}}{3\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{5}}}=\frac{2}{3}$

2. $\left(\frac{3}{4}\right)^3\cdot\frac{20}{27}-\frac{1}{8}=\left(\frac{3}{4}\cdot\frac{3}{4}\cdot\frac{3}{4}\right)\left(\frac{20}{27}\right)-\frac{1}{8}$

$$=\frac{\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 5}{2\cdot 2\cdot 2\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}}-\frac{1}{8}$$
$$=\frac{5}{16}-\frac{1}{8}$$
$$=\frac{5}{16}-\frac{2}{16}$$
$$=\frac{3}{16}$$

3. $\frac{13}{4}$

4. $44 \div 11 = 4; \dfrac{8 \cdot 4}{11 \cdot 4} = \dfrac{32}{44}$

5. $\dfrac{11}{18} = \dfrac{44}{72}, \dfrac{17}{24} = \dfrac{51}{72}, \dfrac{11}{18} < \dfrac{17}{24}$

6.
$$18\frac{1}{6} = 18\frac{7}{42} = 17\frac{49}{42}$$
$$-3\frac{5}{7} = 3\frac{30}{42} = 3\frac{30}{42}$$
$$14\frac{19}{42}$$

7.
$$\frac{2}{7}\left(\frac{5}{8} - \frac{1}{3}\right) \div \frac{3}{5} = \frac{2}{7}\left(\frac{15}{24} - \frac{8}{24}\right) \div \frac{3}{5}$$
$$= \frac{2}{7}\left(\frac{7}{24}\right) \div \frac{3}{5} = \frac{1}{12} \div \frac{3}{5} = \frac{1}{12} \times \frac{5}{3} = \frac{5}{36}$$

8. $2\dfrac{1}{3} \times 3\dfrac{7}{8} = \dfrac{7}{3} \times \dfrac{31}{8} = \dfrac{7 \cdot 31}{3 \cdot 8} = \dfrac{217}{24} = 9\dfrac{1}{24}$

9. $1\dfrac{1}{3} \div \dfrac{2}{3} = \dfrac{4}{3} \div \dfrac{2}{3} = \dfrac{4}{3} \times \dfrac{3}{2} = \dfrac{4 \cdot 3}{3 \cdot 2} = \dfrac{2 \cdot \cancel{2} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{2}} = 2$

10.
$$\frac{17}{24} = \frac{34}{48}$$
$$-\frac{3}{16} = \frac{9}{48}$$
$$\frac{25}{48}$$

11.
$$8\frac{2}{3} \div 2\frac{3}{5} = \frac{26}{3} \div \frac{13}{5} = \frac{26}{3} \times \frac{5}{13} = \frac{26 \cdot 5}{3 \cdot 13} = \frac{2 \cdot \cancel{13} \cdot 5}{3 \cdot \cancel{13}}$$
$$= \frac{10}{3} = 3\frac{1}{3}$$

12.

	2	3	5
$20 =$	$2 \cdot 2$		5
$48 =$	$2 \cdot 2 \cdot 2 \cdot 2$	3	

GCF $= 2 \cdot 2 = 4$

13. $36 \div 12 = 3; \dfrac{2 \cdot 12}{3 \cdot 12} = \dfrac{24}{36}$

14. $\dfrac{15}{28} \div \dfrac{5}{7} = \dfrac{15}{28} \times \dfrac{7}{5} = \dfrac{15 \cdot 7}{28 \cdot 5} = \dfrac{3 \cdot \cancel{5} \cdot \cancel{7}}{2 \cdot 2 \cdot \cancel{7} \cdot \cancel{5}} = \dfrac{3}{4}$

15.
$$\frac{2}{3} = \frac{12}{18}$$
$$\frac{5}{6} = \frac{15}{18}$$
$$+\frac{2}{9} = \frac{4}{18}$$
$$\frac{31}{18} = 1\frac{13}{18}$$

16.
$$2\frac{1}{4} \times 7\frac{1}{3} = \frac{9}{4} \times \frac{22}{3} = \frac{9 \cdot 22}{4 \cdot 3} = \frac{3 \cdot \cancel{3} \cdot \cancel{2} \cdot 11}{\cancel{2} \cdot 2 \cdot \cancel{3}}$$
$$= \frac{33}{2} = 16\frac{1}{2}$$

17.

	2	3
$18 =$	2	$3 \cdot 3$
$12 =$	$2 \cdot 2$	3

LCM $= 2 \cdot 2 \cdot 3 \cdot 3 = 36$

18. $\dfrac{16}{24} = \dfrac{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot 11} = \dfrac{4}{11}$

19.
$$\frac{3}{8}$$
$$\frac{5}{8}$$
$$+\frac{1}{8}$$
$$\frac{9}{8} = 1\frac{1}{8}$$

20. $\dfrac{11}{50} \times \dfrac{25}{44} = \dfrac{11 \cdot 25}{50 \cdot 44} = \dfrac{\cancel{11} \cdot \cancel{5} \cdot \cancel{5}}{2 \cdot \cancel{5} \cdot \cancel{5} \cdot 2 \cdot 2 \cdot \cancel{11}} = \dfrac{1}{8}$

21.
$$4\frac{4}{9} = 4\frac{24}{54}$$
$$2\frac{1}{6} = 2\frac{9}{54}$$
$$+11\frac{17}{27} = 11\frac{34}{54}$$
$$17\frac{67}{54} = 18\frac{13}{54}$$

22.

$$\begin{array}{rcc} & 3 & 5 \\ 15 = & 3 & \textcircled{5} \\ 25 = & & 5 \cdot 5 \end{array}$$

$\text{GCF} = 5$

23.

$$5\overline{)17}\quad \begin{array}{r} 3 \\ -15 \\ \hline 2 \end{array} \qquad \frac{17}{5} = 3\frac{2}{5}$$

24.

$$\frac{4}{5} - \frac{2}{3}^{\,2} \div \frac{4}{15} = \frac{12}{15} - \frac{10}{15}^{\,2} \div \frac{4}{15}$$

$$= \frac{2}{15}^{\,2} \div \frac{4}{15} = \frac{2}{15}\,\frac{2}{15} \div \frac{4}{15}$$

$$= \frac{4}{225} \times \frac{15}{4} = \frac{4 \cdot 15}{225 \cdot 4} = \frac{1}{15}$$

25.

$$\begin{array}{r} \frac{3}{8} = \frac{9}{24} \\ 1\frac{2}{3} = 1\frac{16}{24} \\ +3\frac{5}{6} = 3\frac{20}{24} \\ \hline 4\frac{45}{24} = 5\frac{21}{24} = 5\frac{7}{8} \end{array}$$

26.

$$\begin{array}{rcc} & 2 & 3 \\ 18 = & \textcircled{2} & 3 \cdot 3 \\ 27 = & & \textcircled{3 \cdot 3 \cdot 3} \end{array}$$

$\text{LCM} = 2 \cdot 3 \cdot 3 \cdot 3 = 54$

27.

$$\begin{array}{r} \frac{11}{18} \\ -\frac{5}{18} \\ \hline \frac{6}{18} = \frac{1}{3} \end{array}$$

28. $2\frac{5}{7} = \frac{14+5}{7} = \frac{19}{7}$

29. $\frac{5}{6} \div \frac{5}{12} = \frac{5}{6} \cdot \frac{12}{5} = \frac{5 \cdot 12}{6 \cdot 5} = \frac{\overset{1}{\cancel{5}} \cdot \overset{1}{\cancel{2}} \cdot 2 \cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{5}}} = 2$

30. $\frac{5}{12} \times \frac{4}{25} = \frac{5 \cdot 4}{12 \cdot 25} = \frac{\overset{1}{\cancel{5}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}}}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 3 \cdot \underset{1}{\cancel{5}} \cdot 5} = \frac{1}{15}$

31.

$$\begin{array}{r} 16 = 15\frac{8}{8} \\ -5\frac{7}{8} = 5\frac{7}{8} \\ \hline 10\frac{1}{8} \end{array}$$

32. $1\frac{7}{8}$

33. **Strategy** To find the total rainfall for the 3 months, add the amounts of rain from each month $\left(5\frac{7}{8}, 6\frac{2}{3}, \text{ and } 8\frac{3}{4} \text{ inches}\right)$.

Solution

$$\begin{array}{r} 5\frac{7}{8} = 5\frac{21}{24} \\ 6\frac{2}{3} = 6\frac{16}{24} \\ +8\frac{3}{4} = 8\frac{18}{24} \\ \hline 19\frac{55}{24} = 21\frac{7}{24} \end{array}$$

The total rainfall for the 3 months was $21\frac{7}{24}$ inches.

34. **Strategy** To find the cost of each acre, divide the total cost ($168,000) by the number of acres $4\frac{2}{3}$.

Solution

$$168{,}000 \div 4\frac{2}{3} = 168{,}000 \div \frac{14}{3}$$

$$= 168{,}000 \times \frac{3}{14}$$

$$= 36{,}000$$

The cost per acre was $36,000.

35. **Strategy** To find how many miles the second checkpoint is from the finish line:

• Add the distance to the first checkpoint $\left(4\frac{1}{2}\ miles\right)$ to the distance between the first checkpoint and the second checkpoint $\left(5\frac{3}{4}\ miles\right)$.

• Subtract the total distance to the second checkpoint from the entire length of the race (15 miles).

Solution

$$4\frac{1}{2}=4\frac{2}{4} \qquad 15=14\frac{4}{4}$$
$$+5\frac{3}{4}=5\frac{3}{4} \qquad -10\frac{1}{4}=10\frac{1}{4}$$
$$9\frac{5}{4}=10\frac{1}{4} \qquad 4\frac{3}{4}$$

The second checkpoint is $4\frac{3}{4}$ miles from the finish line.

36. Strategy To find how many miles the car can travel, multiply the number of miles the car can travel on 1 gallon (36) by the number of gallons used $6\frac{3}{4}$.

Solution

$$36\times 6\frac{3}{4}=36\times\frac{27}{4}=\frac{36\cdot 27}{4}=24$$

The car can travel 243 miles.

Chapter 2 Test

1. $\frac{9}{11}\times\frac{44}{81}=\frac{9\cdot 44}{11\cdot 81}=\frac{\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot 2\cdot 2\cdot\overset{1}{\cancel{11}}}{\underset{1}{\cancel{11}}\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot 3\cdot 3}=\frac{4}{9}$

2.

	2	3	5
$24=$	$2\cdot 2\cdot 2$	3	
$80=$	$2\cdot 2\cdot 2\cdot 2$		5

$\text{GCF}=2\cdot 2\cdot 2=8$

3. $\frac{5}{9}\div\frac{7}{18}=\frac{5}{9}\times\frac{18}{7}=\frac{5\cdot 2\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot 7}=\frac{10}{7}=1\frac{3}{7}$

4. $\left(\frac{3}{4}\right)^2\div\left(\frac{2}{3}+\frac{5}{6}\right)-\frac{1}{12}=\frac{3}{4}\cdot\frac{3}{4}\div\left(\frac{4}{6}+\frac{5}{6}\right)-\frac{1}{12}$

$$=\frac{9}{16}\div\left(\frac{9}{6}\right)-\frac{1}{12}$$
$$=\frac{9}{16}\div\frac{3}{2}-\frac{1}{12}$$
$$=\frac{9}{16}\times\frac{2}{3}-\frac{1}{12}$$
$$\frac{\overset{1}{\cancel{3}}\cdot 3\cdot\overset{1}{\cancel{2}}}{2\cdot 2\cdot 2\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{3}}}-\frac{1}{12}=\frac{3}{8}-\frac{1}{12}=\frac{9}{24}-\frac{2}{24}=\frac{7}{24}$$

5. $9\frac{4}{5}=\frac{45+4}{5}=\frac{49}{5}$

6.

$$5\frac{2}{3}\times 1\frac{7}{17}=\frac{17}{3}\times\frac{24}{17}=\frac{17\cdot 24}{3\cdot 17}=\frac{\overset{1}{\cancel{17}}\cdot 2\cdot 2\cdot 2\cdot\overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{17}}}=8$$

7. $\frac{40}{64}=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 5}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot 2\cdot 2\cdot 2}=\frac{5}{8}$

8. $\frac{3}{8}=\frac{9}{24},\frac{5}{12}=\frac{10}{24},\frac{3}{8}<\frac{5}{12}$

9. $\left(\frac{1}{4}\right)^3\div\left(\frac{1}{8}\right)^2-\frac{1}{6}=\left(\frac{1}{4}\cdot\frac{1}{4}\cdot\frac{1}{4}\right)\div\left(\frac{1}{8}\cdot\frac{1}{8}\right)-\frac{1}{6}$

$$=\frac{1}{64}\div\frac{1}{64}-\frac{1}{6}$$
$$=\frac{1}{64}\times\frac{64}{1}-\frac{1}{6}$$
$$=1-\frac{1}{6}$$
$$=\frac{6}{6}-\frac{1}{6}=\frac{5}{6}$$

10.

	2	3	5
$24=$	$2\cdot 2\cdot 2$	③	
$40=$	$2\cdot 2\cdot 2$		⑤

$\text{LCM}=2\cdot 2\cdot 2\cdot 3\cdot 5=120$

11.
$$\begin{array}{r} \frac{17}{24} \\ -\frac{11}{24} \\ \hline \frac{6}{24} = \frac{1}{4} \end{array}$$

12.
$$\begin{array}{r} 3 \\ 5\overline{)18} \\ \underline{-15} \\ 3 \end{array} \qquad \frac{18}{5} = 3\frac{3}{5}$$

13. $6\frac{2}{3} \div 3\frac{1}{6} = \frac{20}{3} \div \frac{19}{6} = \frac{20}{3} \times \frac{6}{19}$

$$= \frac{2 \cdot 2 \cdot 5 \cdot 2 \cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \cdot 19} = \frac{40}{19} = 2\frac{2}{19}$$

14. $72 \div 8 = 9$; $\frac{5 \cdot 9}{8 \cdot 9} = \frac{45}{72}$

15.
$$\begin{array}{r} \frac{5}{6} = \frac{75}{90} \\ \frac{7}{9} = \frac{70}{90} \\ +\frac{1}{15} = \frac{6}{90} \\ \hline \frac{151}{90} = 1\frac{61}{90} \end{array}$$

16.
$$\begin{array}{r} 23\frac{1}{8} = 23\frac{11}{88} = 22\frac{99}{88} \\ -9\frac{9}{44} = 9\frac{18}{88} = 9\frac{18}{88} \\ \hline 13\frac{81}{88} \end{array}$$

17.
$$\begin{array}{r} \frac{9}{16} = \frac{27}{48} \\ -\frac{5}{12} = \frac{20}{48} \\ \hline \frac{7}{48} \end{array}$$

18. $\left(\frac{2}{3}\right)^4\left(\frac{27}{32}\right) + \frac{1}{32} = \left(\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3}\right)\left(\frac{27}{32}\right) + \frac{1}{32}$

$$= \frac{\overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot 3 \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 2} + \frac{1}{32}$$

$$= \frac{1}{6} + \frac{1}{32}$$

$$= \frac{16}{96} + \frac{3}{96}$$

$$= \frac{19}{96}$$

19.
$$\begin{array}{r} \frac{7}{12} \\ \frac{11}{12} \\ +\frac{5}{12} \\ \hline \frac{23}{12} = 1\frac{11}{12} \end{array}$$

20.
$$\begin{array}{r} 12\frac{5}{12} = 12\frac{25}{60} \\ +9\frac{17}{20} = 9\frac{51}{60} \\ \hline 21\frac{76}{60} = 22\frac{16}{60} = 22\frac{4}{15} \end{array}$$

21. $\frac{11}{4}$

22. **Strategy** To find the electrician's earnings, multiply daily earnings ($240) by the number of days worked $\left(3\frac{1}{2}\right)$.

Solution
$$240 \times 3\frac{1}{2} = 240 \times \frac{7}{2}$$
$$= \frac{240 \cdot 7}{2} = 840$$

The electrician earns $840.

23. **Strategy** To find how many lots were available:

• Find how many acres were

being developed by subtracting the amount set aside for the park $\left(1\frac{3}{4}\ acres\right)$ from the total parcel $\left(7\frac{1}{4}\ acres\right)$.

• Divide the amount being developed by the size of each lot $\left(\frac{1}{2}\ acre\right)$.

Solution

$$7\frac{1}{4} = 6\frac{5}{4}$$
$$-1\frac{3}{4} = 1\frac{3}{4}$$
$$5\frac{2}{4} = 5\frac{1}{2}$$

$$5\frac{1}{2} \div \frac{1}{2} = \frac{11}{2} \times \frac{2}{1} = \frac{11 \cdot 2}{2} = 11$$

11 lots were available for sale.

24. Strategy To determine the actual wall lengths, multiply the numerical value of each measurement in inches by 2 and change the units to feet.

Solution Wall a:

$$6\frac{1}{4} \times 2 = \frac{25}{4} \times \frac{2}{1} = \frac{25 \cdot \overset{1}{\cancel{2}}}{\underset{2}{\cancel{4}} \cdot 1} = \frac{25}{2} = 12\frac{1}{2}$$

The actual length of wall a is $12\frac{1}{2}$ feet.

Wall b: $9 \times 2 = 18$

The actual length of wall 8 is 18 feet.

Wall c:

$$7\frac{7}{8} \times 2 = \frac{63}{8} \times \frac{2}{1} = \frac{63 \cdot \overset{1}{\cancel{2}}}{\underset{4}{\cancel{8}} \cdot 1} = \frac{63}{4} = 15\frac{3}{4}$$

The actual length of wall c is $15\frac{3}{4}$ feet.

25. Strategy To find the total rainfall for the 3-month period, add the rainfall amounts for each of the months $\left(11\frac{1}{2}, 7\frac{5}{8}, \text{and } 2\frac{1}{3} \text{ inches}\right)$.

Solution

$$11\frac{1}{2} = 11\frac{12}{24}$$
$$7\frac{5}{8} = 7\frac{15}{24}$$
$$+2\frac{1}{3} = 2\frac{8}{24}$$
$$20\frac{35}{24} = 21\frac{11}{24}$$

The total rainfall for the 3-month period was $21\frac{11}{24}$ inches.

Cumulative Review Exercises

1. 290,000

2.

$$\begin{array}{r} \overset{8\,\cancel{1}\!\overset{9}{0}\,\cancel{/}\!\overset{9}{10}\,\overset{13}{3}17}{} \\ 390,047 \\ -\ 98,769 \\ \hline 291,278 \end{array}$$

3.

$$\begin{array}{r} 926 \\ \times\ \ 79 \\ \hline 8334 \\ 6482\ \ \\ \hline 73,154 \end{array}$$

4.
$$\begin{array}{r} 540\text{ r}12 \\ 57\overline{)30,792} \\ \underline{-285} \\ 229 \\ \underline{-228} \\ 12 \\ \underline{-0} \\ 12 \end{array}$$

5. $4\cdot(6-3)\div 6-1 = 4\cdot 3\div 6-1$
$= 12\div 6-1$
$= 2-1$
$= 1$

6.
$$\begin{array}{r|l} 2 & 44 \\ 2 & 22 \\ 11 & 11 \\ & 1 \end{array}$$
$44 = 2\cdot 2\cdot 11$

7.
$$\begin{array}{r|cccc} & 2 & 3 & 5 & 7 \\ 30 = & 2 & 3 & 5 & \\ 42 = & 2 & 3 & & 7 \end{array}$$
$\text{LCM} = 2\cdot 3\cdot 5\cdot 7 = 210$

8.
$$\begin{array}{r|ccc} & 2 & 3 & 5 \\ 60 = & 2\cdot 2 & 3 & 5 \\ 80 = & 2\cdot 2\cdot 2\cdot 2 & & 5 \end{array}$$
$\text{GCF} = 2\cdot 2\cdot 5 = 20$

9. $7\frac{2}{3} = \frac{21+2}{3} = \frac{23}{3}$

10.
$$\begin{array}{r} 6\ r1 \\ 4\overline{)25} \\ \underline{-24} \\ 1 \end{array}$$
$\frac{25}{4} = 6\frac{1}{4}$

11. $48\div 16 = 3$; $\frac{5\cdot 3}{16\cdot 3} = \frac{15}{48}$

12. $\frac{24}{60} = \frac{2\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{3}}\cdot 5} = \frac{2}{5}$

13.
$$\begin{array}{r} \frac{7}{12} = \frac{28}{48} \\ +\frac{9}{16} = \frac{27}{48} \\ \hline \frac{55}{48} = 1\frac{7}{48} \end{array}$$

14.
$$\begin{array}{r} 3\frac{7}{8} = 3\frac{42}{48} \\ 7\frac{5}{12} = 7\frac{20}{48} \\ +2\frac{15}{16} = 2\frac{45}{48} \\ \hline 12\frac{107}{48} = 14\frac{11}{48} \end{array}$$

15.
$$\begin{array}{r} \frac{11}{12} = \frac{22}{24} \\ -\frac{3}{8} = \frac{9}{24} \\ \hline \frac{13}{24} \end{array}$$

16.
$$\begin{array}{r} 5\frac{1}{6} = 5\frac{3}{18} = 4\frac{21}{18} \\ -3\frac{7}{18} = 3\frac{7}{18} = 3\frac{7}{18} \\ \hline 1\frac{14}{18} = 1\frac{7}{9} \end{array}$$

17. $\frac{3}{8}\times\frac{14}{15} = \frac{3\cdot 14}{8\cdot 15} = \frac{\overset{1}{\cancel{3}}\cdot \overset{1}{\cancel{2}}\cdot 7}{2\cdot 2\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{3}}\cdot 5} = \frac{7}{20}$

18. $3\frac{1}{8}\times 2\frac{2}{5} = \frac{25}{8}\times\frac{12}{5} = \frac{25\cdot 12}{8\cdot 5}$
$= \frac{5\cdot \overset{1}{\cancel{5}}\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot 3}{2\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{5}}} = \frac{15}{2} = 7\frac{1}{2}$

19. $\frac{7}{16}\div\frac{5}{12} = \frac{7}{16}\times\frac{12}{5} = \frac{7\cdot 12}{16\cdot 5}$
$= \frac{7\cdot \overset{1}{\cancel{2}}\cdot \overset{1}{\cancel{2}}\cdot 3}{\underset{1}{\cancel{2}}\cdot \underset{1}{\cancel{2}}\cdot 2\cdot 2\cdot 5} = \frac{21}{20} = 1\frac{1}{20}$

20. $6\frac{1}{8} \div 2\frac{1}{3} = \frac{49}{8} \div \frac{7}{3} = \frac{49}{8} \times \frac{3}{7} = \frac{49 \cdot 3}{8 \cdot 7}$

$= \frac{7 \cdot \overset{1}{\cancel{7}} \cdot 3}{2 \cdot 2 \cdot 2 \cdot \underset{1}{\cancel{7}}} = \frac{21}{8} = 2\frac{5}{8}$

21. $\left(\frac{1}{2}\right)^3 \cdot \frac{8}{9} = \left(\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}\right) \cdot \frac{8}{9} = \frac{1}{8} \cdot \frac{8}{9} = \frac{1}{9}$

22. $\left(\frac{1}{2} + \frac{1}{3}\right) \div \left(\frac{2}{5}\right)^2 = \left(\frac{3}{6} + \frac{2}{6}\right) \div \left(\frac{2}{5} \cdot \frac{2}{5}\right)$

$= \frac{5}{6} \div \frac{4}{25} = \frac{5}{6} \times \frac{25}{4} = \frac{5 \cdot 25}{6 \cdot 4} = \frac{125}{24} = 5\frac{5}{24}$

23. **Strategy** To find the amount in the checking account:

• Find the total of the checks written by adding the check amounts ($128, $54, and $315).

• Subtract the total of the checks written from the original balance in the checking account ($1359).

Solution

$$\begin{array}{r} 128 \\ 54 \\ +315 \\ \hline 497 \end{array} \qquad \begin{array}{r} 1359 \\ -497 \\ \hline 862 \end{array}$$

The amount in the checking account at the end of the week was $862.

24. **Strategy** To find the total income from the sale of the tickets:

• Find the income from the adult tickets by multiplying the ticket price ($10) by the number of tickets sold (87).

• Find the income from the student tickets by multiplying the ticket price ($4) by the number of tickets sold (135).

• Find the total income by adding the income from the adult tickets to the income from the student tickets.

Solution

$$\begin{array}{r} 87 \\ \times\ 10 \\ \hline 870 \end{array} \qquad \begin{array}{r} 135 \\ \times\ 4 \\ \hline 540 \end{array} \qquad \begin{array}{r} 870 \\ +\ 540 \\ \hline 1410 \end{array}$$

The total income from the tickets was $1410.

25. **Strategy** To find the total weight, add the three weights $\left(1\frac{1}{2}, 7\frac{7}{8}, \text{ and } 2\frac{2}{3} \text{ pounds}\right)$.

Solution

$$\begin{array}{r} 1\frac{1}{2} = 1\frac{12}{24} \\ 7\frac{7}{8} = 7\frac{21}{24} \\ +2\frac{2}{3} = 2\frac{16}{24} \\ \hline 10\frac{49}{24} = 12\frac{1}{24} \end{array}$$

The total weight is $12\frac{1}{24}$ pounds.

26. **Strategy** To find the length of the remaining piece, subtract the length of the cut piece $\left(2\frac{5}{8} \text{ feet}\right)$ from the original length of the board $\left(7\frac{1}{3} \text{ feet}\right)$.

Solution

$$\begin{array}{r} 7\frac{1}{3} = 7\frac{8}{24} = 6\frac{32}{24} \\ -2\frac{5}{8} = 2\frac{15}{24} = 2\frac{15}{24} \\ \hline 4\frac{17}{24} \end{array}$$

The length of the remaining

piece is $4\frac{17}{24}$ feet.

27. **Strategy** To find how many miles the car can travel, multiply the number of gallons used $8\frac{1}{3}$ by the number of miles that the car travels on each gallon (27).

Solution

$$27 \times 8\frac{1}{3} = 27 \times \frac{25}{3} = 225$$

The car travels 225 miles on $8\frac{1}{3}$ gallons of gas.

28. **Strategy** To find how many parcels can be sold:

• Find the amount of land that can be developed by subtracting the land donated for a park (2 acres) from the total amount of land purchased $\left(10\frac{1}{3} \text{ acres}\right)$.

• Divide the amount of land that can be developed by the size of each parcel $\left(\frac{1}{3} \text{ acres}\right)$.

Solution

$$\begin{array}{r} 10\frac{1}{3} \\ \underline{-2} \\ 8\frac{1}{3} \end{array}$$

$$8\frac{1}{3} \div \frac{1}{3} = \frac{25}{3} \div \frac{1}{3} = \frac{25}{3} \times \frac{3}{1} = 25$$

25 parcels can be sold from the remaining land.

Chapter 3: Decimals

Prep Test

1. $\frac{3}{10}$

2. 36,900

3. Four thousand seven hundred ninety-one

4. 6842

5. 9394

6. 1638

7.
$$\begin{array}{r} 844 \\ \times\ 91 \\ \hline 844 \\ 7596 \\ \hline 76{,}804 \end{array}$$

8.
$$\begin{array}{r} 278 \text{ r}18 \\ 23\overline{)6412} \\ -46 \\ \hline 181 \\ -161 \\ \hline 202 \\ -184 \\ \hline 18 \end{array}$$

Section 3.1

Concept Check

1. The digit 5 is in the thousandths place.

3. The digit 5 is in the ten-thousandths place.

5. $\frac{3}{10} = 0.3$ (three tenths)

7. $\frac{853}{1000} = 0.853$

(eight hundred fifty - three thousandths)

9. $0.59 = \frac{59}{100}$ (fifty-nine-hundredths)

Objective A Exercises

11. Thirty-seven-hundredths

13. Nine and four-tenths

15. Fifty-three-ten-thousandths

17. Forty-five-thousandths

19. Twenty-six and four-hundredths

21. 3.0806

23. 407.03

25. 246.024

27. 73.02684

Objective B Exercises

29.
Given place value
6.249
$4 < 5$
6.249 rounded to the nearest tenth is 6.2.

31.
Given place value
21.007
$0 < 5$
21.007 rounded to the nearest tenth is 21.0.

33.
Given place value
18.40937
$9 > 5$
18.40937 rounded to the nearest hundredth is 18.41.

35.
Given place value
72.4983
$8 > 5$
72.4983 rounded to the nearest hundredth is 72.50.

37.
Given place value
936.2905
$5 = 5$
936.2905 rounded to the nearest thousandth is 936.291.

39.

Given place value

47.3192

$3 < 5$

47.3192 rounded to the nearest whole number is 47.

41.

Given place value

7014.96

$9 > 5$

7014.96 rounded to the nearest whole number is 7015.

43.

Given place value

2.975268

$8 > 5$

2.975268 rounded to the nearest hundred-thousandth is 2.97527.

45.

Given place value

699.723

$7 > 5$

699.723 rounded to the nearest whole number is 700.

47. 0.1763668 rounded to the nearest hundredth is 0.18. The weight of a nickel to the nearest hundredth is 0.18 ounce.

49. 26.21875 rounded to the nearest tenth is 26.2. To the nearest tenth, the Boston Marathon is 26.2 miles.

51. Answers will vary. For example 0.572

Objective C Exercises

53. $0.278 > 0.203$

55. $0.045 > 0.038$

57. $0.037 < 0.13$

59. $0.031 > 0.00987$

61. $0.02883 < 0.0305$

63. $0.0072 > 0.0008294$

Critical Thinking

65a. Answers will vary. For example, 0.11, 0.12, 0.13, 0.14, 0.15, 0.16, 0.17, 0.18, and 0.19 are numbers between 0.1 and 0.2. But any number of digits can be attached to 0.1, and the number will be between 0.1 and 0.2. For example, 0.123456789 is a number between 0.1 and 0.2.

b. Answers will vary. For example, 1.01, 1.02, 1.03, 1.04, 1.05, 1.06, 1.07, 1.08, and 1.09 are numbers between 1 and 1.1. But any number of digits can be attached to 1.0, and the number will be between 1 and 1.1. For example, 1.0123456789 is a number between 1 and 1.1.

c. Answers will vary. For example, 0.001, 0.002, 0.003 and 0.004 are numbers between 0 and 0.005. But any number of digits can be attached to 0.001, 0.002, 0.003, or 0.004, and the number will be between 0 and 0.005. For example, 0.00123456789 is a number between 0 and 0.005.

Section 3.2

Concept Check

1. To make sure that digits of the same place value are added

Objective A Exercises

3.
$$\begin{array}{r} {\scriptstyle 1\ \ 1\,1} \\ 16.008 \\ 2.0385 \\ +\ 132.06 \\ \hline 150.1065 \end{array}$$

5.
$$\begin{array}{r} {\scriptstyle 1\ \ 1} \\ 1.792 \\ 67. \\ +\ 27.0526 \\ \hline 95.8446 \end{array}$$

7.
$$\begin{array}{r} {\scriptstyle 1} \\ 3.02 \\ 62.7 \\ +\ 3.924 \\ \hline 69.644 \end{array}$$

9.
$$\begin{array}{r} {\scriptstyle 1\,1\ \ 1} \\ 82.006 \\ 9.95 \\ +\ 0.927 \\ \hline 92.883 \end{array}$$

11.
$$\begin{array}{r} {\scriptstyle 2\,1\ \ 1\,1} \\ 4.307 \\ 99.82 \\ +\ 9.078 \\ \hline 113.205 \end{array}$$

13.
$$\begin{array}{r} {\scriptstyle 2\,1\ \ 1} \\ 8.72 \\ 99.073 \\ +\ 2.9736 \\ \hline 110.7666 \end{array}$$

15.
$$\begin{array}{r} {\scriptstyle 1} \\ 0.0944 \\ +\ 1.5522 \\ \hline 1.6466 \end{array}$$

17.
$$\begin{array}{r} {\scriptstyle 1\ \ 1} \\ 99.552 \\ +\ 8.09 \\ \hline 107.642 \end{array}$$

19.
$$\begin{array}{rcr} 219.9 & \approx & 220 \\ 0.872 & \approx & 1 \\ +\ 13.42 & \approx & +\ 13 \\ \hline \text{Cal.: } 234.192 & & \text{Est.: } 234 \end{array}$$

21.
$$\begin{array}{rcr} 678.92 & \approx & 679 \\ 97.6 & \approx & 98 \\ +\ 5.423 & \approx & +\ 5 \\ \hline \text{Cal.: } 781.943 & & \text{Est.: } 782 \end{array}$$

23. Yes

Objective B Exercises

25. **Strategy** To find the length of the shaft, add the three measures on the shaft (0.53 foot, 2.3 feet, and 1.52 feet).

Solution
$$\begin{array}{r} 0.53 \\ 2.3 \\ +1.52 \\ \hline 4.35 \end{array}$$

The total length of the shaft is 4.35 feet.

27. **Strategy** To find the perimeter of the trapezoid, add the lengths of the sides (1.36, 0.55, 1.12, and 0.5 meters).

Solution
$$\begin{array}{r} {\scriptstyle 1\ \ 1} \\ 1.36 \\ 0.55 \\ 1.12 \\ +\ 0.5 \\ \hline 3.53 \end{array}$$

The perimeter of the trapezoid is 3.53 meters.

29. **Strategy** To find the total average number of viewers per day for these news programs that week, add the average number of viewers for each program (8.2 million, 7.2 million, and 5.7 million).

Solution

$$\begin{array}{r} 8.2 \\ 7.2 \\ +\ 5.7 \\ \hline 21.1 \end{array}$$

That week there were 21.1 million viewers per day for these three news programs.

31.

$$\begin{array}{r} 1.4 \\ \times\ \ 4 \\ \hline 5.6 \end{array}$$

No, a 4-foot rope cannot be wrapped all the way around the box.

Critical Thinking

33. Three possible answers are bread, butter, and mayonnaise; raisin bran, butter, and bread; and lunch meat, milk, and popcorn. Other answers are possible.

Projects or Group Activities

35. $0.079 + 0.13 = \frac{79}{1000} + \frac{13}{100}$

$= \frac{79}{1000} + \frac{130}{1000}$

$= \frac{209}{1000}$

37. $0.053 + 0.09 + 0.1077$

$= \frac{53}{1000} + \frac{9}{100} + \frac{1077}{10,000}$

$= \frac{530}{10,000} + \frac{900}{10,000} + \frac{1077}{10,000}$

$= \frac{2507}{10,000}$

Section 3.3

Concept Check

1. $9.37 - 6.19 = 3.18$

$9.37 = 6.19 + 3.18$

3. $0.03 - 0.0095 = 0.0205$

$0.0205 + 0.0095 = 0.03$

Objective A Exercises

5.

$$\begin{array}{r} {\scriptstyle 13} \\ 1\ 3\ 10 \\ 24.037 \\ -18.41 \\ \hline 5.627 \end{array}$$

7.

$$\begin{array}{r} {\scriptstyle 12\quad\ 9} \\ 1\ 2\ 10\ 6\ 10\ 10 \\ 123.0700 \\ -\ 9.4273 \\ \hline 113.6427 \end{array}$$

9.

$$\begin{array}{r} {\scriptstyle 15\ 14\ 9\ 9} \\ 0\ 5\ 4\ 10\ 10\ 10 \\ 16.5000 \\ -\ 9.7902 \\ \hline 6.7098 \end{array}$$

11.

$$\begin{array}{r} {\scriptstyle 18} \\ 6\ 8\ 10 \\ 235.790 \\ -\ \ 20.093 \\ \hline 215.697 \end{array}$$

13.

$$\begin{array}{r} {\scriptstyle 12\ 9\ 9\ 14} \\ 5\ 2\ 10\ 10\ 4\ 10 \\ 63.0050 \\ -\ 9.1274 \\ \hline 53.8776 \end{array}$$

15.

$$\begin{array}{r} {\scriptstyle 11\ \ 9\ 9\ 9} \\ 8\ 1\ 10\ 10\ 10\ 10 \\ 92.0000 \\ -\ 19.2909 \\ \hline 72.7091 \end{array}$$

17.

$$\begin{array}{r} {\scriptstyle 9} \\ 1\ 10\ 10 \\ 0.3200 \\ -0.0058 \\ \hline 0.3142 \end{array}$$

19.
$$\begin{array}{r} {\scriptstyle 9}\\ 3.\not{0}\not{0}5\\ -1.982\\ \hline 1.023 \end{array}$$

21.
$$\begin{array}{r} {\scriptstyle 10\ 15}\\ 35\not{2}.\not{1}\not{6}0\\ -\ 90.994\\ \hline 261.166 \end{array}$$

23.
$$\begin{array}{r} {\scriptstyle 11}\\ 7\not{2}4.32\\ -\ 69.\\ \hline 655.32 \end{array}$$

25.
$$\begin{array}{r} {\scriptstyle 11\ \ 13}\\ 3\not{6}2.\not{3}940\\ -\ 19.4672\\ \hline 342.9268 \end{array}$$

27.
$$\begin{array}{r} {\scriptstyle 9\ 9}\\ 1\not{9}.\not{0}\not{0}0\\ 10.372\\ \hline 8.628 \end{array}$$

29.
$$\begin{array}{r} {\scriptstyle 7\ \not{1}\ 14\ 5\ 10}\\ 2\not{8}\not{2}.\not{4}\not{6}\not{0}\\ -\ 9\ 7.7\ 3\ 2\\ \hline 1\ 8\ 4.7\ 2\ 8 \end{array}$$

31.
$$\begin{array}{r} {\scriptstyle 2\ \not{0}\ \not{3}\ \not{4}\ 10}\\ 0.\not{3}\not{1}\not{4}\not{5}\not{0}\\ -\ 0.0\ 3\ 8\ 5\ 2\\ \hline 0.2\ 7\ 5\ 9\ 8 \end{array}$$

33. $7.01 - 2.325$

35. $19.35 - 8.967$

37.
$$\begin{array}{rcr} 3.7529 & \approx & 4\\ -1.00784 & \approx & -1 \end{array}$$
Cal.: 2.74506 Est.: 3

39.
$$\begin{array}{rcr} 9.07325 & \approx & 9\\ -1.924 & \approx & -2 \end{array}$$
Cal.: 7.14925 Est.: 7

Objective B Exercises

41. **Strategy** To find the missing dimension, subtract 1.72 from 4.31.

Solution
$$\begin{array}{r} 4.31\\ -1.72\\ \hline 2.59 \end{array}$$

The missing dimension is 2.59 feet.

43. **Strategy** To find the increase in the average price of a ticket between 2007 ($6.88) and 2009 ($7.50), subtract the smaller number from the larger number.

Solution
$$\begin{array}{r} 7.50\\ -\ 6.88\\ \hline 0.62 \end{array}$$

The increase in the average ticket price from 2007 to 2009 was $.62.

45. **Strategy** To find the number of people, subtract the number who watched the post-game show (63.9 million) from the number who watched the Super Bowl (97.4 million).

Solution
$$\begin{array}{r} 97.4\\ -63.9\\ \hline 33.5 \end{array}$$

33.5 million more people watched the Super Bowl than the post-game show.

Critical Thinking

47a. Rounding to tenths, the largest difference between a decimal and the decimal rounded to

tenths is 0.05. Example: For numbers between 3.7 and 3.8, (1) Any number between 3.7 and 3.75 (not including 3.75) is rounded to 3.7, so the largest difference is *less than* 0.05.

(2) Any number between 3.75 and 3.8 (including 3.75) is rounded to 3.8, so the largest difference is *equal to* 0.05.

Therefore, rounding to tenths, the largest amount by which the estimate of the sum of two decimals could differ from the exact sum is the sum of the largest differences for each decimal.

0.05 + 0.05 = 0.1.

b. For hundredths, 0.005 + 0.005 = 0.01.

c. For thousandths, 0.0005 + 0.0005 = 0.001.

Projects or Group Activities

49. $0.87 - 0.531 = \frac{87}{100} - \frac{531}{1000}$

$= \frac{870}{1000} - \frac{531}{1000}$

$= \frac{339}{1000}$

51. $0.097 - 0.069531 = \frac{97}{1000} - \frac{69,531}{1,000,000}$

$= \frac{97,000}{1,000,000} - \frac{69,531}{1,000,000}$

$= \frac{27,469}{1,000,000}$

Check Your Progress: Chapter 3

1. $\frac{7}{10}$

2. $\frac{17}{1000}$

3. $\frac{93}{100}$

4. $\frac{87}{100,000}$

5. Twenty-three and forty-five thousandths

6. 305.0057

7.

357.79645 (6 > 5) ← Given place value

357.79645 rounded to the nearest hundredth is 357.80.

8. 0.357 < 0.4

9. 0.056 > 0.0107

10. 0.00319 < 0.005

11.
$$\begin{array}{r} 9.03 \\ 1.15 \\ +\ 6 \\ \hline 16.18 \end{array}$$

12.
$$\begin{array}{r} {\scriptstyle 1\ 16\ 14} \\ \not{2}\not{7}.\not{4}7 \\ -\ 9.5 \\ \hline 17.97 \end{array}$$

13.
$$\begin{array}{r} {\scriptstyle 2\ 10\quad 6\ 9\ 10} \\ \not{3}\not{0}8.\not{7}\not{0}\not{0} \\ -\ 192.483 \\ \hline 116.217 \end{array}$$

14.
$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 7.306 \\ 82.9912 \\ +\ 0.1 \\ \hline 90.3972 \end{array}$$

15.
$$\begin{array}{r} {\scriptstyle 2\,2\,1\ \ 1\,1} \\ 96.54 \\ 749.453 \\ +\ 154.007 \\ \hline 1000.000 \end{array}$$

16.
$$\begin{array}{r} {\scriptstyle 6\ \ 11\ \ 10\ \ 10\ \ 6\ \ 10} \\ \not{7}\not{2}.\not{1}\not{0}\not{7}\not{0} \\ -\ 5\,3.9\,5\,6\,2 \\ \hline 1\,8.1\,5\,0\,8 \end{array}$$

Section 3.4

Objective A Exercises

1. 10^2

3. 10^6

5. 10,000,000

7. $2+1=3$

9. $2+3=5$

Objective A Exercises

11.
$$\begin{array}{r} 0.9 \\ \times\ 0.4 \\ \hline 0.36 \end{array}$$

13.
$$\begin{array}{r} 0.5 \\ \times\ 0.5 \\ \hline 0.25 \end{array}$$

15.
$$\begin{array}{r} 7.7 \\ \times\ 0.9 \\ \hline 6.93 \end{array}$$

17.
$$\begin{array}{r} 9.2 \\ \times\ 0.2 \\ \hline 1.84 \end{array}$$

19.
$$\begin{array}{r} 7.4 \\ \times\ 0.1 \\ \hline 0.74 \end{array}$$

21.
$$\begin{array}{r} 7.9 \\ \times\ 5 \\ \hline 39.5 \end{array}$$

23.
$$\begin{array}{r} 0.68 \\ \times\ 4 \\ \hline 2.72 \end{array}$$

25.
$$\begin{array}{r} 0.67 \\ \times\ 0.9 \\ \hline 0.603 \end{array}$$

27.
$$\begin{array}{r} 2.5 \\ \times\ 5.4 \\ \hline 13.50 \end{array}$$

29.
$$\begin{array}{r} 0.83 \\ \times\ 5.2 \\ \hline 166 \\ 415 \\ \hline 4.316 \end{array}$$

31.
$$\begin{array}{r} 1.47 \\ \times\ 0.09 \\ \hline 0.1323 \end{array}$$

33.
$$\begin{array}{r} 8.92 \\ \times\ 0.004 \\ \hline 0.03568 \end{array}$$

35.
$$\begin{array}{r} 0.49 \\ \times\ 0.16 \\ \hline 294 \\ 49 \\ \hline 0.0784 \end{array}$$

37.
$$\begin{array}{r} 7.6 \\ \times\ 0.01 \\ \hline 0.076 \end{array}$$

39.
$$\begin{array}{r} 8.62 \\ \times\ 4 \\ \hline 34.48 \end{array}$$

41.
$$\begin{array}{r} 64.5 \\ \times\ 9 \\ \hline 580.5 \end{array}$$

43.
$$\begin{array}{r} 2.19 \\ \times\ 9.2 \\ \hline 438 \\ 1971 \\ \hline 20.148 \end{array}$$

45.
$$\begin{array}{r} 1.85 \\ \times\ 0.023 \\ \hline 555 \\ 370 \\ \hline 0.04255 \end{array}$$

47.
$$\begin{array}{r} 0.478 \\ \times\ 0.37 \\ \hline 3346 \\ 1434 \\ \hline 0.17686 \end{array}$$

49.
$$\begin{array}{r} 48.3 \\ \times\ 0.0041 \\ \hline 483 \\ 1932 \\ \hline 0.19803 \end{array}$$

51.
$$\begin{array}{r} 4.29 \\ \times\ 0.1 \\ \hline 0.429 \end{array}$$

53.
$$\begin{array}{r} 5.29 \\ \times\ 0.4 \\ \hline 2.116 \end{array}$$

55.
$$\begin{array}{r} 0.68 \\ \times\ 0.7 \\ \hline 0.476 \end{array}$$

57.
$$\begin{array}{r} 1.4 \\ \times\ 0.73 \\ \hline 42 \\ 98 \\ \hline 1.022 \end{array}$$

59.
$$\begin{array}{r} 3.8 \\ \times\ 0.61 \\ \hline 38 \\ 228 \\ \hline 2.318 \end{array}$$

61.
$$\begin{array}{r} 3.2808 \\ \times\ 3 \\ \hline 9.8424 \end{array}$$
The height is 9.8424 feet.

63. $0.32 \times 10 = 3.2$

65. $0.065 \times 100 = 6.5$

67. $6.2856 \times 1000 = 6285.6$

69. $3.57 \times 10{,}000 = 35{,}700$

71. $0.63 \times 10^1 = 6.3$

73. $0.039 \times 10^2 = 3.9$

75. $4.9 \times 10^4 = 49{,}000$

77. $0.067 \times 10^2 = 6.7$

79.
$$\begin{array}{r} 3.45 \\ \times\ 0.0035 \\ \hline 1725 \\ 1035 \\ \hline 0.012075 \end{array}$$

81.
$$\begin{array}{r} 0.00392 \\ \times\ 3.005 \\ \hline 1960 \\ 1176 \\ \hline 0.01177960 \end{array}$$
or 0.0117796

83.
$$\begin{array}{r} 1.348 \\ \times\ 0.23 \\ \hline 4044 \\ 2696 \\ \hline 0.31004 \end{array}$$

85.
$$\begin{array}{r} 23.67 \\ \times\ 0.0035 \\ \hline 11835 \\ 7101 \\ \hline 0.082845 \end{array}$$

87.
$$\begin{array}{r} 0.45 \\ \times 5 \\ \hline 2.25 \end{array} \qquad \begin{array}{r} 2.25 \\ \times 2.3 \\ \hline 675 \\ 450 \\ \hline 5.175 \end{array}$$

89. $28.5 \approx 30$, $\times\ 3.2 \approx \times\ 3$

Cal.: 91.2 Est.: 90

91. $2.38 \approx 2$, $\times\ 0.44 \approx \times\ 0.4$

Cal.: 1.0472 Est.: 0.8

93. $0.866 \approx 0.9$, $\times\ 4.5 \approx \times\ 5$

Cal.: 3.897 Est.: 4.5

95. $4.34 \approx 4$, $\times\ 2.59 \approx \times\ 3$

Cal.: 11.2406 Est.: 12

97. $8.434 \approx 8$, $\times\ 0.044 \approx \times\ 0.04$

Cal.: 0.371096 Est.: 0.32

99. $28.44 \approx 30$, $\times\ 1.12 \approx \times\ 1$

Cal.: 31.8528 Est.: 30

Objective B Exercises

101. **Strategy** To find the amount received for the cans, multiply the weight (18.75 pounds) by the cost per pound ($.75).

Solution
$$\begin{array}{r} 18.75 \\ \times\ 0.75 \\ \hline 9375 \\ 1312.5 \\ \hline 14.06525 \approx 14.06 \end{array}$$

The amount received for the cans is $14.06.

103. **Strategy** To find the average annual cost, multiply the monthly bill ($103.67) by the number of months in a year (12).

Solution
$$\begin{array}{r} 103.67 \\ \times\ 12 \\ \hline 207\ 34 \\ 1036\ 7 \\ \hline 1244.04 \end{array}$$

The average annual cost is $1244.04.

105. **Strategy** To find the deduction, multiply the number of miles driven while doing charitable work (1843) by the deduction amount per mile ($.14).

Solution
$$\begin{array}{r} 1843 \\ \times\ 0.14 \\ \hline 73\ 72 \\ 184\ 3 \\ \hline 258.02 \end{array}$$

The mileage deduction is $258.02.

107. The deduction for driving a car 2374 miles for business

109. **Strategy** To find the amount due in taxes, multiply the number of gallons (12.5) by the tax per gallon ($.477).

Solution

$$\begin{array}{r} 0.477 \\ \times\ 12.5 \\ \hline 2385 \\ 954 \\ 477 \\ \hline 5.9625 \end{array}$$

The taxes paid will be $5.96.

111. Strategy To find the area of a square, multiply the length (6.75 feet) by the width (3.5 feet).

Solution

$$\begin{array}{r} 6.75 \\ \times\ \ 3.5 \\ \hline 3375 \\ 2025 \\ \hline 23.625 \end{array}$$

The area is 23.625 square feet.

113a. Strategy To find the amount of overtime pay, multiply the overtime rate ($149.35) by the number of hours worked (15).

Solution

$$\begin{array}{r} 149.35 \\ \times\ \ 15 \\ \hline 74675 \\ 14935 \\ \hline 2240.25 \end{array}$$

The amount of overtime pay is $2240.25.

b. Strategy To find the nurse's total income for the week, add the overtime pay ($2240.25) to the salary ($3440).

Solution

$$\begin{array}{r} 2240.25 \\ +\ 3440.00 \\ \hline 5680.25 \end{array}$$

The nurse's total income is $5680.25.

115. Strategy To find the amount that would have been saved, multiply the number of checks issued (136 million) by the cost to issue each check ($.92).

Solution

$$\begin{array}{r} 136 \\ \times\ 0.92 \\ \hline 2\,72 \\ 122\,4 \\ \hline 125.12 \end{array}$$

The federal government would have saved $125.12 million, or $125,120,000.

117a.

$$\begin{array}{r} 2.2 \\ \times 8 \\ \hline 17.6 \\ \times 3.2 \\ \hline 352 \\ 528 \\ \hline 56.32 \end{array}$$

The total cost of grade 1 is $56.32.

b.

$$\begin{array}{r} 3.4 \\ \times\ \ 6.5 \\ \hline 170 \\ 204 \\ \hline 22.10 \\ \times\ \ 3.35 \\ \hline 11050 \\ 6630 \\ 6630 \\ \hline 74.035 \end{array}$$

The total cost of grade 2 is $74.04.

c.

$$\begin{array}{r} 6.75 \\ \times\ 15.4 \\ \hline 2700 \\ 3375 \\ 675 \\ \hline 103.950 \\ \times\ \ 3.94 \\ \hline 415800 \\ 935550 \\ 31185 \\ \hline 409.563 \end{array}$$

The total cost of grade 3 is $409.56.

d. Grade 1 $ 56.32
Grade 2 74.04
Grade 3 + 409.56
Total: $539.92

The total cost is $539.92.

Critical Thinking

119.

$$1.3 = 1\frac{3}{10}$$

$$2.31 = 2\frac{31}{100}$$

$$1\frac{3}{10} \times 2\frac{31}{100} = \frac{13}{10} \times \frac{231}{100} = \frac{3003}{1000} = 3\frac{3}{1000} = 3.003$$

121. Add the number of decimal places in each of the numbers being multiplied. The number of decimal places in the product is equal to this sum.

Section 3.5

Concept Check

1. To determine the placement of the decimal point in the quotient of two decimals, move the decimal point in the divisor to the right to make the divisor a whole number. Make the decimal point in the dividend the same number of places to the right. Place the decimal point in the quotient directly above the decimal point in the dividend.

Objective A Exercises

3.

$$\begin{array}{r} 0.82 \\ 3\overline{)2.46} \\ -24 \\ \hline 06 \\ -06 \\ \hline 0 \end{array}$$

5.

$$\begin{array}{r} 4.8 \\ 0.8.\overline{)3.8.4} \\ -32 \\ \hline 64 \\ -64 \\ \hline 0 \end{array}$$

7.

$$\begin{array}{r} 89. \\ 0.7.\overline{)62.3.} \\ -56 \\ \hline 63 \\ -63 \\ \hline 0 \end{array}$$

9.

$$\begin{array}{r} 60. \\ 0.4.\overline{)24.0.} \\ -24 \\ \hline 00 \\ -0 \\ \hline 0 \end{array}$$

11.

$$\begin{array}{r} 84.3 \\ 0.7.\overline{)59.0.1} \\ -56 \\ \hline 30 \\ -28 \\ \hline 21 \\ -21 \\ \hline 0 \end{array}$$

13.

$$\begin{array}{r} 32.3 \\ 0.5.\overline{)16.1.5} \\ -15 \\ \hline 11 \\ -10 \\ \hline 15 \\ -15 \\ \hline 0 \end{array}$$

15.

$$\begin{array}{r} 5.06 \\ 0.7.\overline{)3.5.42} \\ -35 \\ \hline 04 \\ -0 \\ \hline 42 \\ -42 \\ \hline 0 \end{array}$$

17.

$$\begin{array}{r} 1.3 \\ 6.3.\overline{)8.1.9} \\ -63 \\ \hline 189 \\ -189 \\ \hline 0 \end{array}$$

19.

$$\begin{array}{r} 0.11 \\ 3.6.\overline{)0.3.96} \\ -36 \\ \hline 36 \\ -36 \\ \hline 0 \end{array}$$

21.

$$
\begin{array}{r}
3.8 \\
6.9.\overset{\frown}{)}26.2.2 \\
\underline{-207} \\
552 \\
\underline{-552} \\
0
\end{array}
$$

23.

$$
\begin{array}{r}
6.32 \approx 6.3 \\
8.8.\overset{\frown}{)}55.6.20 \\
\underline{-528} \\
282 \\
\underline{-264} \\
180 \\
\underline{-176} \\
4
\end{array}
$$

25.

$$
\begin{array}{r}
0.57 \approx 0.6 \\
9.5.\overset{\frown}{)}5.4.27 \\
\underline{-475} \\
677 \\
\underline{-665} \\
12
\end{array}
$$

27.

$$
\begin{array}{r}
2.52 \approx 2.5 \\
7.3.\overset{\frown}{)}18.4.00 \\
\underline{-146} \\
380 \\
\underline{-365} \\
150 \\
\underline{-146} \\
4
\end{array}
$$

29.

$$
\begin{array}{r}
1.07 \approx 1.1 \\
0.17.\overset{\frown}{)}0.18.30 \\
\underline{-17} \\
13 \\
\underline{-\ 0} \\
130 \\
\underline{-119} \\
11
\end{array}
$$

31.

$$
\begin{array}{r}
0.808 \approx 0.81 \\
8\overline{)6.467} \\
\underline{-64} \\
06 \\
\underline{-\ 0} \\
67 \\
\underline{-64} \\
3
\end{array}
$$

33.

$$
\begin{array}{r}
0.089 \approx 0.09 \\
0.72.\overset{\frown}{)}0.06.470 \\
\underline{-\ 576} \\
710 \\
\underline{-\ 648} \\
62
\end{array}
$$

35.

$$
\begin{array}{r}
40.70 \\
0.95.\overset{\frown}{)}38.66.5 \\
\underline{-380} \\
66 \\
\underline{-\ 0} \\
665 \\
\underline{-665} \\
0
\end{array}
$$

37.

$$
\begin{array}{r}
0.456 \approx 0.46 \\
60.8.\overset{\frown}{)}27.7.380 \\
\underline{-\ 2432} \\
3418 \\
\underline{-3040} \\
3780 \\
\underline{-3648} \\
132
\end{array}
$$

39.

$$
\begin{array}{r}
0.0190 \approx 0.019 \\
54\overline{)1.0280} \\
\underline{-\ 54} \\
488 \\
\underline{-486} \\
20 \\
\underline{-\ 0} \\
0
\end{array}
$$

41.

$$
\begin{array}{r}
0.3600 \approx 0.360 \\
95.3.\overset{\frown}{)}34.3.1000 \\
\underline{-2859} \\
5720 \\
\underline{-5718} \\
20 \\
\underline{-\ 0} \\
200 \\
\underline{-\ \ 0} \\
200
\end{array}
$$

43.

$$
\begin{array}{r}
0.1031 \approx 0.103 \\
4.72.\overset{\frown}{)}0.48.7100 \\
\underline{-\ 472} \\
151 \\
\underline{-\ 0} \\
1510 \\
\underline{-1416} \\
940 \\
\underline{-472} \\
468
\end{array}
$$

45.

$$
\begin{array}{r}
0.0086 \approx 0.009 \\
26.7.\overset{\frown}{)}0.2.3070 \\
\underline{-2136} \\
1710 \\
\underline{-1602} \\
108
\end{array}
$$

47.

$$
\begin{array}{r}
0.9 \approx 1 \\
90\overline{)89.76} \\
\underline{-810} \\
87
\end{array}
$$

49.
$$\begin{array}{r} 2.5 \approx 3 \\ 0.413\overline{)1.047.8} \\ -826 \\ \hline 2218 \\ -2065 \\ \hline 153 \end{array}$$

51.
$$\begin{array}{r} 1.0 \approx 1 \\ 0.778\overline{)0.790.0} \\ -778 \\ \hline 120 \end{array}$$

53.
$$\begin{array}{r} 56.8 \approx 57 \\ 6.9\overline{)392.0.0} \\ -345 \\ \hline 470 \\ -414 \\ \hline 560 \\ -552 \\ \hline 8 \end{array}$$

55.
$$\begin{array}{r} 1.0375 \\ 4\overline{)4.1500} \\ -4 \\ \hline 1 \\ -0 \\ \hline 15 \\ -12 \\ \hline 30 \\ -28 \\ \hline 20 \\ -20 \\ \hline 0 \end{array}$$

57. $4.07 \div 10 = 0.407$

59. $42.67 \div 10 = 4.267$

61. $1.037 \div 100 = 0.01037$

63. $8.295 \div 1000 = 0.008295$

65. $0.32 \div 10^1 = 0.032$

67. $23.627 \div 10^2 = 0.23627$

69. $0.0053 \div 10^2 = 0.000053$

71. $1.8932 \div 10^3 = 0.0018932$

73.
$$\begin{array}{r} 18.42 \\ 2.4\overline{)44.2.08} \\ -24 \\ \hline 202 \\ -192 \\ \hline 100 \\ -\ 96 \\ \hline 48 \\ -48 \\ \hline 0 \end{array}$$

75.
$$\begin{array}{r} 16.07 \\ 45\overline{)723.15} \\ -45 \\ \hline 273 \\ -270 \\ \hline 31 \\ -\ 0 \\ \hline 315 \\ -315 \\ \hline 0 \end{array}$$

77. $13.5 \div 10^3 = 0.0135$

79. $23.678 \div 1000 = 0.023678$

81.
$$\begin{array}{r} 0.112 \\ 0.05\overline{)0.00.560} \\ -5 \\ \hline 06 \\ -\ 5 \\ \hline 10 \\ -10 \\ \hline 0 \end{array}$$

83. Cal.: $42.42 \div 3.8 = 11.1632$
Est.: $40 \div 4 = 10$

85. Cal.: $389 \div 0.44 = 884.0909$
Est.: $400 \div 0.4 = 1000$

87. Cal.: $6.394 \div 3.5 = 1.8269$
Est.: $6 \div 4 = 1.5$

89. Cal.: $1.235 \div 0.021 = 58.8095$
Est.: $1 \div 0.02 = 50$

91. Cal.: $95.443 \div 1.32 = 72.3053$
Est.: $100 \div 1 = 100$

Objective B Exercises

93a. Division

b. Multiplication

95. **Strategy** To find the number of miles the driver must drive in an hour, divide the hourly wage ($16.00) by the amount earned per mile ($.46).

Solution

$$
\begin{array}{r}
34.7 \approx 35 \\
.46\overline{)16.00.0} \\
-138 \\
\hline
220 \\
-184 \\
\hline
360 \\
-322 \\
\hline
38
\end{array}
$$

The driver must drive 35 miles in an hour to earn $16.00 per hour.

97. **Strategy** To find the number of yards per carry, divide the total number of yards (162) by the number of carries (26).

Solution

$$
\begin{array}{r}
6.230 \approx 6.23 \\
26\overline{)162.000} \\
-156 \\
\hline
60 \\
-52 \\
\hline
80 \\
-78 \\
\hline
20 \\
-0 \\
\hline
0
\end{array}
$$

6.23 yards are gained per carry.

99. **Strategy** To find the number of complete shelves, divide the board length (12 feet) by the length of a shelf (3.4 feet). The answer is the whole-number part of the quotient.

Solution

$$
\begin{array}{r}
58.65 \\
12\overline{)703.80} \\
-60 \\
\hline
103 \\
-96 \\
\hline
78 \\
-72 \\
\hline
60 \\
-60 \\
\hline
0
\end{array}
$$

The board can be cut into 3 shelves.

101. **Strategy** To find the monthly truck payment:

- Subtract the amount of the down payment ($1500) from the price of the truck ($14,307.60).
- Divide the result by the number of monthly payments (60).

Solution

$$
\begin{array}{r}
\$14,307.60 \\
-\ 1\,500.00 \\
\hline
\$12,807.60
\end{array}
$$

$$
\begin{array}{r}
213.46 \\
60\overline{)12,807.60} \\
-120 \\
\hline
80 \\
-\ 60 \\
\hline
207 \\
-180 \\
\hline
276 \\
-240 \\
\hline
360 \\
-360 \\
\hline
0
\end{array}
$$

The monthly payment is $213.46.

103. **Strategy** To find the mileage per gallon:

• Subtract 17,814.2 from 18,130.4 to find the number of miles driven.

• Divide the number of miles driven by the amount of gas used (12.4 gallons).

Solution

$$\begin{array}{r} 18{,}130.4 \\ -17{,}814.2 \\ \hline 316.2 \end{array}$$

$$12.4\overline{)316.2.0}$$

$$\begin{array}{r} 25.5 \\ -248 \\ \hline 682 \\ -620 \\ \hline 620 \\ -620 \\ \hline 0 \end{array}$$

The car can travel 25.5 miles on 1 gallon of gasoline.

105. **Strategy** To find the amount of oil used in one year:

- Multiply the amount of electricity used in one month (27 kilowatt-hours) by the number of months in one year (12).
- Divide the yearly amount by the amount of electricity produced by one barrel of oil (800 kilowatt-hours).

Solution

$$\begin{array}{r} 27 \\ \times\ 12 \\ \hline 54 \\ 27 \\ \hline 324 \end{array}$$

$$800\overline{)324.000}$$

$$\begin{array}{r} 0.405 \\ -3200 \\ \hline 4000 \\ -4000 \\ \hline 0 \end{array}$$

The amount of oil used in one year is 0.405 barrel.

Critical Thinking

107. **Strategy** To find how many more women than men were enrolled at institutions of higher learning, subtract the number of men (7.46 million) from the expected number of women (10.03 million).

Solution

$$\begin{array}{rl} 10.03 & \text{million} \\ -\ 7.46 & \text{million} \\ \hline 2.57 & \text{million} \end{array}$$

2.57 million more women were enrolled at institutions of higher learning.

109. **Strategy** To find how many times greater the Army's advertising budget is than the Navy's advertising budget, divide the Army's budget ($85.3 million) by the Navy's budget ($20.5 million).

Solution $85.3 \div 20.5 \approx 4.2$

The Army's advertising budget was 4.2 times greater than the Navy's.

111. **Strategy** To find how many times greater the population of 85 and over is expected to be in 2030 than in 2000, divide the expected population in 2030 (8.9 million) by the population in 2000 (4.2 million).

Solution $8.9 \div 4.2 \approx 2.1$

The population of this segment is expected to be 2.1 times greater in 2030 than in 2000.

113. To calculate a batting average, divide the number of hits by the number of times at bat. Round to the nearest thousandth. Magglio Ordonez's batting average $= 216 \div 595 = 0.363$.

Projects or Group Activities

115. $3.46 \times 0.24 = 0.8304$

117. $0.064 \times 1.6 = 0.1024$

119. $3.0381 \div 1.23 = 2.47$

121. 2.53

123. 0.27

Section 3.6

Concept Check

1. Thousandths

3. Tenths

5. Hundredths

7. Greater than 1

9. Less than 1

Objective A Exercises

11.
$$\begin{array}{r} 0.66 \\ 3\overline{)2.00} \\ -18 \\ \hline 20 \\ -18 \\ \hline 2 \end{array} \qquad \frac{2}{3} = 0.66... = 0.\overline{6}$$

13.
$$\begin{array}{r} 0.875 \\ 8\overline{)7.000} \\ -64 \\ \hline 60 \\ -56 \\ \hline 40 \\ -40 \\ \hline 0 \end{array} \qquad \frac{7}{8} = 0.875$$

15.
$$\begin{array}{r} 0.722 \\ 18\overline{)13.000} \\ -126 \\ \hline 40 \\ -36 \\ \hline 40 \\ -36 \\ \hline 4 \end{array} \qquad \frac{13}{18} = 0.722... = 0.7\overline{2}$$

17.
$$\begin{array}{r} 0.6060 \\ 33\overline{)20.0000} \\ -198 \\ \hline 20 \\ -0 \\ \hline 200 \\ -198 \\ \hline 20 \\ -0 \\ \hline 20 \end{array} \qquad \frac{20}{33} = 0.6060... = 0.\overline{60}$$

19.
$$\begin{array}{r} 0.4722 \\ 36\overline{)17.0000} \\ -144 \\ \hline 260 \\ -252 \\ \hline 80 \\ -72 \\ \hline 80 \\ -72 \\ \hline 8 \end{array} \qquad \frac{17}{36} = 0.4722... = 0.47\overline{2}$$

21.
$$\begin{array}{r} 0.729729 \\ 37\overline{)27.000000} \\ -259 \\ \hline 110 \\ -74 \\ \hline 360 \\ -333 \\ \hline 270 \\ -259 \\ \hline 110 \\ -74 \\ \hline 360 \\ -333 \\ \hline 27 \end{array}$$

$\frac{27}{37} = 0.729729... = 0.\overline{729}$

23.
$$\begin{array}{r} 0.925925 \\ 27\overline{)25.000000} \\ -243 \\ \hline 70 \\ -54 \\ \hline 160 \\ -135 \\ \hline 250 \\ -243 \\ \hline 70 \\ -54 \\ \hline 160 \\ -135 \\ \hline 25 \end{array}$$

$\frac{25}{27} = 0.925925... = 0.\overline{925}$

25.
$$\begin{array}{r} 0.47294729 \\ 74\overline{)35.00000000} \\ -296 \\ \hline 540 \\ -518 \\ \hline 220 \\ -148 \\ \hline 720 \\ -666 \\ \hline 540 \\ -518 \\ \hline 220 \\ -148 \\ \hline 720 \\ -666 \\ \hline 54 \end{array}$$

$\frac{35}{74} = 0.47294729... = 0.\overline{4729}$

27.
$$\begin{array}{r} 0.85 \\ 20\overline{)17.00} \\ -160 \\ \hline 100 \\ -100 \\ \hline 0 \end{array}$$

$\frac{17}{20} = 0.85$

29.
$$\begin{array}{r} 0.857142 \\ 7\overline{)6.000000} \\ -56 \\ \hline 40 \\ -35 \\ \hline 50 \\ -49 \\ \hline 10 \\ -7 \\ \hline 30 \\ -28 \\ \hline 20 \\ -14 \\ \hline 6 \end{array}$$

$\frac{6}{7} = 0.\overline{857142}$

31. $32\overline{)11.00000}$ $\quad \frac{11}{32} = 0.34375$

$$\begin{array}{r} 0.34375 \\ 32\overline{)11.00000} \\ -96 \\ \hline 140 \\ -128 \\ \hline 120 \\ -96 \\ \hline 240 \\ -224 \\ \hline 160 \\ -160 \\ \hline 0 \end{array}$$

33. $20\overline{)77.00}$ $\quad \frac{77}{20} = 3.85$

$$\begin{array}{r} 3.85 \\ 20\overline{)77.00} \\ -60 \\ \hline 170 \\ -160 \\ \hline 100 \\ -100 \\ \hline 0 \end{array}$$

35. $55\overline{)233.00000}$ $\quad \frac{233}{55} = 4.23636... = 4.2\overline{36}$

$$\begin{array}{r} 4.23636 \\ 55\overline{)233.00000} \\ -220 \\ \hline 130 \\ -110 \\ \hline 200 \\ -165 \\ \hline 350 \\ -330 \\ \hline 200 \\ -165 \\ \hline 350 \\ -330 \\ \hline 20 \end{array}$$

Objective B Exercises

37. $0.4 = \frac{4}{10} = \frac{2}{5}$

39. $0.48 = \frac{48}{100} = \frac{12}{25}$

41. $0.485 = \frac{485}{1000} = \frac{97}{200}$

43. $3.75 = 3\frac{75}{100} = 3\frac{3}{4}$

45. $3.175 = 3\frac{175}{1000} = 3\frac{\overset{1}{\cancel{5}}\cdot\overset{1}{\cancel{5}}\cdot 7}{\underset{1}{\cancel{5}}\cdot\underset{1}{\cancel{5}}\cdot 40} = 3\frac{7}{40}$

47. $11.004 = 11\frac{4}{1000} = 11\frac{1}{250}$

49. $9.279 = 9\frac{279}{1000}$

51. $0.224 = \frac{224}{1000} = \frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 28}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot 125} = \frac{28}{125}$

53. $0.052 = \frac{52}{1000} = \frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot 13}{\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot 250} = \frac{13}{250}$

55. $0.00015 = \frac{15}{100{,}000} = \frac{\overset{1}{\cancel{5}}\cdot 3}{\underset{1}{\cancel{5}}\cdot 20{,}000} = \frac{3}{20{,}000}$

57. $67\overline{)21.000}$ $\quad \frac{21}{67} \approx 0.31$

$$\begin{array}{r} 0.313 \\ 67\overline{)21.000} \\ -201 \\ \hline 90 \\ -67 \\ \hline 230 \\ -201 \\ \hline 29 \end{array}$$

59. $43\overline{)7.0000}$ $\quad \frac{7}{43} \approx 0.163$

$$\begin{array}{r} 0.1627 \\ -43 \\ \hline 270 \\ -258 \\ \hline 120 \\ -86 \\ \hline 340 \\ -301 \\ \hline 39 \end{array}$$

61. $56\overline{)5.0000}$ $\quad \frac{5}{56} \approx 0.089$

$$\begin{array}{r} 0.0892 \\ -448 \\ \hline 520 \\ -504 \\ \hline 160 \\ -112 \\ \hline 48 \end{array}$$

63. $17\overline{)12.00000}$ $\quad \frac{12}{17} \approx 0.7059$

$$\begin{array}{r} 0.70588 \\ -119 \\ \hline 100 \\ -85 \\ \hline 150 \\ -136 \\ \hline 140 \\ -136 \\ \hline 4 \end{array}$$

Objective C Exercises

65. $\frac{7}{8} \quad 0.9$

$$\frac{7}{8} \quad \frac{9}{10}$$
$$\frac{35}{40} \quad \frac{36}{40}$$
$$\frac{35}{40} < \frac{36}{40}$$
$$\frac{7}{8} < 0.9$$

67. $0.13 \quad \frac{5}{40}$

$$\frac{13}{100} \quad \frac{5}{40}$$
$$\frac{26}{200} \quad \frac{25}{200}$$
$$\frac{26}{200} > \frac{25}{200}$$
$$0.13 > \frac{5}{40}$$

69. $\frac{12}{55} \quad 0.22$

$$\frac{12}{55} \quad \frac{22}{100}$$
$$\frac{240}{1100} \quad \frac{242}{1100}$$
$$\frac{240}{1100} < \frac{242}{1100}$$
$$\frac{12}{55} < 0.22$$

71. $0.55 \quad \frac{5}{9}$

$$\frac{55}{100} \quad \frac{5}{9}$$
$$\frac{495}{900} \quad \frac{500}{900}$$
$$\frac{495}{900} < \frac{500}{900}$$
$$0.55 < \frac{5}{9}$$

73. $\frac{17}{18} \quad 0.94$

$$\frac{17}{18} \quad \frac{94}{100}$$
$$\frac{850}{900} \quad \frac{846}{900}$$
$$\frac{850}{900} > \frac{846}{900}$$
$$\frac{17}{18} > 0.94$$

75. $\frac{22}{7}$ 3.14

$\frac{22}{7}$ $\frac{314}{100}$

$\frac{2200}{700}$ $\frac{2198}{700}$

$\frac{2200}{700} > \frac{2198}{700}$

$\frac{22}{7} > 3.14$

Critical Thinking

Cars 2 and 5 would fail the test.

Projects or Group Activities

77. 0.5, 0.75, 0.625, 0.5625, 0.3, 0.35, 0.59375, 0.575, 0.28, 0.38

79. 2 and 5

81. Answers will vary. For example, $\frac{5}{6} = 0.8\overline{3}$, $\frac{4}{11} = 0.\overline{36}$, $\frac{9}{13} = 0.\overline{692307}$. No.

Chapter 3 Review Exercises

1.

$$\begin{array}{r} 54.5 \\ 0.067\overline{)3.651.5} \\ -335 \\ \hline 301 \\ -268 \\ \hline 335 \\ -335 \\ \hline 0 \end{array}$$

2.

$$\begin{array}{r} {\scriptstyle 2\ 3\ 1\ 1} \\ 369.41 \\ 88.3 \\ 9.774 \\ +366.474 \\ \hline 833.958 \end{array}$$

3. 0.055 < 0.100; 0.055 < 0.1

4. Twenty-two and ninety-two ten-thousandths

5.

0.05678235 ← Given place value

2 < 5

0.05678

6.

$$\begin{array}{r} 0.2125 \\ 80\overline{)17.0000} \\ -160 \\ \hline 100 \\ -80 \\ \hline 200 \\ -160 \\ \hline 400 \\ -400 \\ \hline 0 \end{array}$$

7. $0.375 = \frac{375}{1000} = \frac{3}{8}$

8.

$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 3.42 \\ 0.794 \\ +\ 32.5 \\ \hline 36.714 \end{array}$$

9. 34.025

10. $\frac{5}{8} = 0.625$

0.625>0.620

$\frac{5}{8} > 0.62$

11.

$$\begin{array}{r} 0.31818 \\ 22\overline{)7.00000} \\ -66 \\ \hline 40 \\ -22 \\ \hline 180 \\ -176 \\ \hline 40 \\ -22 \\ \hline 180 \\ -176 \\ \hline 4 \end{array}$$

$\frac{7}{22} = 0.3\overline{18}$

12. $0.66 = \frac{66}{100} = \frac{33}{50}$

13.
$$\begin{array}{r} {\scriptstyle 12\ 10\ 9}\\ 6\ \not{2}\ \not{0}\ \not{1}0 \\ 2\not{7}\ .\not{3}\not{1}\not{0}\not{0} \\ -\ 4.4465 \\ \hline 22.8635 \end{array}$$

14.
$$\begin{array}{l} \text{Given place value} \\ 7.93704 \\ \text{7} > 5 \end{array}$$

7.93704 rounded to the nearest hundredth is 7.94.

15.
$$\begin{array}{r} 3.08 \\ \times\ 2.9 \\ \hline 2772 \\ 616 \\ \hline 8.932 \end{array}$$

16. Three hundred forty-two and thirty-seven hundredths

17. 3.06753

18.
$$\begin{array}{r} 34.79 \\ \times\ 0.74 \\ \hline 13916 \\ 24353 \\ \hline 25.7446 \end{array}$$

19.
$$\begin{array}{r} 6.594 \\ 0.053\overline{)0.349.482} \\ -318 \\ 314 \\ -265 \\ 498 \\ -477 \\ 212 \\ -212 \\ 0 \end{array}$$

20.
$$\begin{array}{r} {\scriptstyle 15}\\ 6\ 17\ 8\ \not{5}\ 10 \\ 7.\not{7}\not{9}\not{6}\not{0} \\ -\ 2.9\ 175 \\ \hline 4.8\ 785 \end{array}$$

21. **Strategy** To find the total number of gallons of fuel saved this year by the airline, add the amounts saved for each step taken to reduce fuel consumption (2.9 million, 7.2 million, 3.6 million, and 35.4 million).

Solution
$$\begin{array}{r} 2.9 \\ 7.2 \\ 3.6 \\ +35.4 \\ \hline 49.1 \end{array}$$

The airline saved 49.1 million gallons of fuel.

Strategy To find the airline's average cost per gallon of fuel for the year, divide the total amount saved ($131 million) by the number of gallons of fuel saved.

Solution
$$\begin{array}{r} 2.668 \\ 49.1\overline{)131.0.000} \\ -982 \\ 3280 \\ -2946 \\ 3340 \\ -2946 \\ 3940 \\ -3928 \\ 12 \end{array}$$

The airline's average cost per gallon is $2.67.

22. **Strategy** To find the new balance in your checking account:

• Find the total amount of the checks by adding the check amounts ($145.72 and $88.45).

• Subtract the total check amounts from the original balance ($895.68).

Solution

$$\begin{array}{rr} 145.72 & 895.68 \\ +\ 88.45 & -\ 234.17 \\ \hline 234.17 & 661.51 \end{array}$$

The new balance in your account is $661.51.

23. Strategy To find how many times greater the number who drove (30.6 million) was than the number who flew (4.8 million), divide the number who drove by the number who flew.

Solution $30.6 \div 4.8 \approx 6.4$

The number who drove is 6.4 times greater than the number who flew.

24. Strategy To find the amount of milk served during a 5-day school week, multiply the amount of milk served daily (1.9 million gallons) by 5 days.

Solution

$$\begin{array}{r} 1.9 \\ \times\ 5 \\ \hline 9.5 \end{array}$$

During a 5-day school week, 9.5 million gallons of milk are served.

Chapter 3 Test

1. $0.0068 > 0.000963$

2.

$$\begin{array}{r} {\scriptstyle 9}\ \ {\scriptstyle 10\,12} \\ 13.027 \\ -\ 8.940 \\ \hline 4.087 \end{array}$$

3. Forty-five and three hundred two ten-thousandths

4. 209.07086

5. $0.825 = \dfrac{825}{1000} = \dfrac{33}{40}$

6.

$$\begin{array}{r} 1.6 \\ 8\overline{)13.0} \\ -8 \\ \hline 50 \\ -48 \\ \hline 2 \end{array}$$

$\dfrac{13}{8} > 0.72$

7.

$$\begin{array}{r} 1.5378 \approx 1.538 \\ 0.037\overline{)0.056.9000} \\ -37 \\ \hline 199 \\ -185 \\ \hline 140 \\ -111 \\ \hline 290 \\ -259 \\ \hline 310 \\ -296 \\ \hline 14 \end{array}$$

8.

$$\begin{array}{r} {\scriptstyle 16\ 9\ 9\ 12\ 9} \\ 2\ 6\not{1}\not{0}\not{1}\not{0}2\not{1}010 \\ 37.00300 \\ -\ 9.23674 \\ \hline 27.76626 \end{array}$$

9.

$$\begin{array}{r} {\scriptstyle 14\ \ 12\ 13\ \ 9} \\ {\scriptstyle 5}\ \not{6}\ \not{5}.\not{3}\not{4}\not{0}\not{0} \\ -\ 3\ 9.4\ 5\ 9\ 2 \\ \hline 2\ 5.8\ 8\ 0\ 8 \end{array}$$

10.

$$\begin{array}{r} 0.325 \\ 40\overline{)13.000} \\ -120 \\ \hline 100 \\ -80 \\ \hline 200 \\ -200 \\ \hline 0 \end{array}$$

11.

Given place value

7.0954625

$4 < 5$

7.095

12.

$$0.06\overline{)1.39.2}\quad 23.2$$

-12

19

-18

12

-12

0

13.

$$\begin{array}{r} {\scriptstyle 2\,1\,2\,\;1\,3} \\ 270.93 \\ 97. \\ 1.976 \\ +\ 88.675 \\ \hline 458.581 \end{array}$$

14. $22\overline{)15.00000}\quad 0.68181$

-132

180

-176

40

-22

180

-176

40

-22

8

$\frac{15}{22} = 0.68181\ldots = 0.6\overline{81}$

15.

$$\begin{array}{r} 1.37 \\ \times\ 0.004 \\ \hline 0.00548 \end{array}$$

16.

$$\begin{array}{r} {\scriptstyle 11\;\;\;} \\ 62.3 \\ 4.007 \\ +189.65 \\ \hline 255.957 \end{array}$$

17. $17.1496 \times 10^3 = 17{,}149.6$

18. $15.923 \div 10^4 = 0.0015923$

19. **Strategy** To find the cost, multiply the number of bolts (15) by the cost per bolt ($1.44).

Solution

$$\begin{array}{r} 1.44 \\ \times 15 \\ \hline 720 \\ 144 \\ \hline 21.60 \end{array}$$

The cost is $21.60.

20. **Strategy** To find the amount of each payment:

- Find the total amount to be paid by subtracting the down payment ($2500) from the cost of the car ($16,734.40).
- Divide the amount remaining to be paid by the number of payments (36).

Solution

$$\begin{array}{r} 16{,}734.40 \\ -\ 2{,}500.00 \\ \hline 14{,}234.40 \end{array}$$

$36\overline{)14{,}234.40}\quad 395.40$

-108

343

-324

194

-180

144

-144

00

$-\ 0$

0

Each payment is $395.40.

21. **Strategy** To find your total income, add the salary ($727.50), commission ($1909.64), and bonus ($450).

Solution

$$\begin{array}{r} 727.50 \\ 1909.64 \\ +\ \ 450.00 \\ \hline 3087.14 \end{array}$$

Your total income is $3087.14.

22. **Strategy** To find the cost of the 12-minute call:

- Find the number of additional minutes charged above the 3-minute base by subtracting the base (3 minutes) from the total call length (12 minutes).
- Multiply the number of additional minutes by the rate ($.42).
- Add the charge for additional minutes to the base rate ($.85).

Solution $12 - 3 = 9$

$$\begin{array}{r} 0.42 \\ \times\ \ 9 \\ \hline 3.78 \end{array} \qquad \begin{array}{r} 3.78 \\ +0.85 \\ \hline 4.63 \end{array}$$

The cost of the call is $4.63.

Cumulative Review Exercises

1.
$$\begin{array}{r} 235 \text{ r}17 \\ 89\overline{)20932} \\ -178 \\ \hline 313 \\ -267 \\ \hline 462 \\ -445 \\ \hline 17 \end{array}$$

2. $2^3 \cdot 4^2 = 8 \cdot 16 = 128$

3. $2^2 - (7-3) \div 2 + 1$
$= 4 - 4 \div 2 + 1$
$= 4 - 2 + 1$
$= 3$

4.

	2	3
9 =		3 · 3
12 =	2 · 2	3
24 =	2 · 2 · 2	3

$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 72$

5.
$$\begin{array}{r} 4 \text{ r}2 \\ 5\overline{)22} \\ \underline{-20} \\ 2 \end{array} \qquad \frac{22}{5} = 4\frac{2}{5}$$

6. $4\frac{5}{8} = \frac{32+5}{8} = \frac{37}{8}$

7. $60 \div 12 = 5; \quad \frac{5 \cdot 5}{12 \cdot 5} = \frac{25}{60}$

8.
$$\begin{array}{rl} & \frac{3}{8} = \frac{18}{48} \\ & \frac{5}{12} = \frac{20}{48} \\ + & \frac{9}{12} = \frac{27}{48} \\ \hline & \frac{65}{48} = 1\frac{17}{48} \end{array}$$

9.
$$\begin{array}{rl} & 5\frac{7}{12} = 5\frac{21}{36} \\ + & 3\frac{7}{18} = 3\frac{14}{36} \\ \hline & 8\frac{35}{36} \end{array}$$

10.
$$\begin{array}{rl} & 9\frac{5}{9} = 9\frac{20}{36} = 8\frac{56}{36} \\ - & 3\frac{11}{12} = 3\frac{33}{36} = 3\frac{33}{36} \\ \hline & 5\frac{23}{36} \end{array}$$

11. $\frac{9}{16} \times \frac{4}{27} = \frac{9 \times 4}{16 \times 27} = \frac{\overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}}}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 2 \cdot 2 \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot 3} = \frac{1}{12}$

12. $2\frac{1}{8}\times 4\frac{5}{17}=\frac{17}{8}\times\frac{73}{17}=\frac{17\cdot 73}{8\cdot 17}=\frac{73}{8}=9\frac{1}{8}$

13. $\frac{11}{12}\div\frac{3}{4}=\frac{11}{12}\times\frac{4}{3}=\frac{11\cdot 4}{12\cdot 3}$

$$=\frac{11\cdot \cancel{2}\cdot\cancel{2}}{\cancel{2}\cdot\cancel{2}\cdot 3\cdot 3}=\frac{11}{9}=1\frac{2}{9}$$

14. $2\frac{3}{8}\div 2\frac{1}{2}=\frac{19}{8}\div\frac{5}{2}=\frac{19}{8}\times\frac{2}{5}=\frac{19\cdot 2}{8\cdot 5}$

$$=\frac{19\cdot \overset{1}{\cancel{2}}}{2\cdot 2\cdot 2\cdot 5}=\frac{19}{20}$$

15. $\left(\frac{2}{3}\right)^2\left(\frac{3}{4}\right)^3=\left(\frac{2}{3}\cdot\frac{2}{3}\right)\left(\frac{3}{4}\cdot\frac{3}{4}\cdot\frac{3}{4}\right)$

$$=\frac{\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{2}}\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot 3}{\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{2}}\cdot\underset{1}{\cancel{2}}\cdot 2\cdot 2\cdot 2\cdot 2}=\frac{3}{16}$$

16. $\left(\frac{2}{3}\right)^2-\left(\frac{2}{3}-\frac{1}{2}\right)+2$

$=\left(\frac{2}{3}\cdot\frac{2}{3}\right)-\left(\frac{4}{6}-\frac{3}{4}\right)+2$

$=\frac{4}{9}-\frac{1}{6}+2$

$=\frac{8}{18}-\frac{3}{18}+\frac{36}{18}$

$=\frac{41}{18}=2\frac{5}{18}$

17. Sixty-five and three hundred nine ten-thousandths

18.
$$\begin{array}{r} {\scriptstyle 2\ 3\ 1\ 1\ 1\ 1} \\ 379.006 \\ 27.523 \\ 9.8707 \\ +\ 88.2994 \\ \hline 504.6991 \end{array}$$

19.
$$\begin{array}{r} {\scriptstyle 8\ 10\ 9\ 9\ 14\ 10} \\ 29.0050 \\ -\ 7.9286 \\ \hline 21.0764 \end{array}$$

20.
$$\begin{array}{r} 9.074 \\ \times\ \ 6.09 \\ \hline 81666 \\ 544440 \\ \hline 55.26066 \end{array}$$

21.
$$\begin{array}{r} 2.1544 \approx 2.154 \\ 8.09\overset{\frown}{)}17.42.9630 \\ -1618 \\ \hline 1249 \\ -809 \\ \hline 4406 \\ -4045 \\ \hline 3613 \\ -3236 \\ \hline 3770 \\ -3236 \\ \hline 534 \end{array}$$

22.
$$\begin{array}{r} 0.733 \\ 15\overset{\frown}{)}11.000 \\ -105 \\ \hline 50 \\ -45 \\ \hline 50 \\ -45 \\ \hline 5 \end{array}$$

$\frac{11}{15}=0.733...=0.7\overline{3}$

23. $0.425=\frac{425}{1000}=\frac{\overset{1}{\cancel{5}}\cdot\overset{1}{\cancel{5}}\cdot 17}{2\cdot 2\cdot 2\cdot\underset{1}{\cancel{5}}\cdot\underset{1}{\cancel{5}}\cdot 5}=\frac{17}{40}$

24. $\frac{8}{9}\approx 0.89$

$0.89<0.98$

$\frac{8}{9}<0.98$

25. **Strategy** To find how many more vacation days are mandated in Sweden than in Germany, subtract the number of days mandated in Germany (18) from the number of days mandated in Sweden (32).

Solution

$$\begin{array}{r} 32 \\ -18 \\ \hline 14 \end{array}$$

Sweden mandates 14 days more vacation than Germany.

26. Strategy To find the loss needed the third month:

- Add the losses for the first two months.
- Subtract this sum from the goal (24 pounds).

Solution

$$9\frac{1}{2}+6\frac{3}{4}=9\frac{2}{4}+6\frac{3}{4}$$
$$=15\frac{5}{4}=16\frac{1}{4}$$

pounds lost first two months

$$24-16\frac{1}{4}=23\frac{4}{4}-16\frac{1}{4}=7\frac{3}{4}$$

pounds

The patient must lose $7\frac{3}{4}$ pounds the third month to achieve the goal.

27. Strategy To find your balance after you write the checks:

- Find the total of the checks written by adding the amounts of the checks ($42.98, $16.43, and $137.56).
- Subtract the total of the checks written from the original balance ($814.35).

Solution

$$\begin{array}{r} 42.98 \\ 16.43 \\ +137.56 \\ \hline 196.97 \end{array} \qquad \begin{array}{r} 814.35 \\ -196.97 \\ \hline 617.38 \end{array}$$

Your checking account balance is $617.38.

28. Strategy To find the resulting thickness, subtract the amount removed (0.017 inch) from the original thickness (1.412 inches).

Solution

$$\begin{array}{r} 1.412 \\ -0.017 \\ \hline 1.395 \end{array}$$

The resulting thickness is 1.395 inches.

29. Strategy To find the amount of income tax you paid:

- Find the amount of tax paid on profit by multiplying the profit ($64,860) by the rate (0.08).
- Add the amount of tax paid on profit to the base tax ($820).

Solution

$$\begin{array}{r} 64,860 \\ \times\ 0.08 \\ \hline 5188.80 \end{array} \qquad \begin{array}{r} 5188.80 \\ +\ 820.00 \\ \hline 6008.80 \end{array}$$

You paid $6008.80 in income tax last year.

30. Strategy To find the amount of the monthly payment:

- Find the amount to be paid in payments by subtracting the down payment ($40) from the cost ($410.96).
- Divide the amount to be paid in payments by the number of payments (8).

Solution

$$\begin{array}{r} 410.96 \\ -\ 40.00 \\ \hline 370.96 \end{array}$$

$$\begin{array}{r} 46.37 \\ 8\overline{)370.96} \\ -\ 32 \\ \hline 50 \\ -\ 48 \\ \hline 29 \\ -\ 24 \\ \hline 56 \\ -56 \\ \hline 0 \end{array}$$

The amount of each payment is $46.37.

Chapter 4: Ratio and Proportion

Prep Test

1. $\frac{8}{10} = \frac{\overset{1}{\cancel{2}} \cdot 2 \cdot 2}{\underset{1}{\cancel{2}} \cdot 5} = \frac{4}{5}$

2. $\frac{450}{650 + 250} = \frac{450}{900} = \frac{\overset{1}{\cancel{450}}}{2 \cdot \underset{1}{\cancel{450}}} = \frac{1}{2}$

3. $15\overline{)372.0}$ $\quad \frac{24.8}{}$

4. $4 \times 33 = 132$
$62 \times 2 = 124$
$132 > 124$
4×33 is greater.

5. $5\overline{)20}$ $\quad \frac{4}{}$ $\quad 4 \times 5 = 20$

Section 4.1

Concept Check

1. 3 to 8

Objective A Exercises

3. $\frac{3 \text{ pints}}{15 \text{ pints}} = \frac{3}{15} = \frac{1}{5}$
3 pints: 15 pints = 3 : 15 = 1 : 5
3 pints to 15 pints = 3 to 15 = 1 to 5

5. $\frac{\$40}{\$20} = \frac{40}{20} = \frac{2}{1}$
$\$40 : \$20 = 40 : 20 = 2 : 1$
\$40 to \$20 = 40 to 20 = 2 to 1

7. $\frac{3 \text{ miles}}{8 \text{ miles}} = \frac{3}{8}$
3 miles:8 miles = 3:8
3 miles to 8 miles = 3 to 8

9. $\frac{6 \text{ minutes}}{6 \text{ minutes}} = \frac{6}{6} = \frac{1}{1}$
6 minutes : 6 minutes = 6 : 6 = 1 : 1
6 minutes to 6 minutes = 6 to 6 = 1 to 1

11. $\frac{35 \text{ cents}}{50 \text{ cents}} = \frac{35}{50} = \frac{7}{10}$
35 cents:50 cents = 35 : 50 = 7 : 10
35 cents to 50 cents = 35 to 50 = 7 to 10

13. $\frac{30 \text{ minutes}}{60 \text{ minutes}} = \frac{30}{60} = \frac{1}{2}$
30 minutes : 60 minutes = 30 : 60 = 1 : 2
30 minutes to 60 minutes = 30 to 60 = 1 to 2

15. $\frac{32 \text{ ounces}}{16 \text{ ounces}} = \frac{32}{16} = \frac{2}{1}$
32 ounces:16 ounces = 32 : 16 = 2 : 1
32 ounces to 16 ounces = 32 to 16 = 2 to 1

17. $\frac{30 \text{ yards}}{12 \text{ yards}} = \frac{30}{12} = \frac{5}{2}$
30 yards : 12 yards = 30 : 12 = 5 : 2
30 yards to 12 yards = 30 to 12 = 5 to 2

19. $\frac{20 \text{ gallons}}{28 \text{ gallons}} = \frac{20}{28} = \frac{5}{7}$
20 gallons : 28 gallons = 20 : 28 = 5 : 7
20 gallons to 28 gallons = to 20 to 28
= 5 to 7

21. days

Objective B Exercises

23. **Strategy** To find the ratio, write the ratio of utilities (\$300) to food (\$800) in simplest form.

Solution $\frac{\$300}{\$800} = \frac{300}{800} = \frac{3}{8}$

The ratio is $\frac{3}{8}$.

25. **Strategy** To find the ratio, write the ratio of housing ($1600) to total expenses ($4800) in simplest form.

Solution $\frac{\$1600}{\$4800} = \frac{1600}{4800} = \frac{1}{3}$

The ratio is $\frac{1}{3}$.

27. **Strategy** To find the ratio, write the ratio of the number of men who participated (65,000) to the number of adult males in the U.S. (110 million) in simplest form.

Solution $\frac{65,000}{110,000,000} = \frac{65}{110,000}$

$= \frac{13}{22,000}$

The ratio is $\frac{13}{22,000}$.

29. **Strategy** To find the ratio:

- Find the amount of the increase in cost of gasoline by subtracting the lower cost ($2.70 per gallon) from the higher cost ($3.24 per gallon).
- Write the ratio of the amount of the increase to the original price ($2.70) in simplest form.

Solution

$$\begin{array}{r} 3.24 \\ -2.70 \\ \hline 0.54 \end{array}$$

$\frac{\$.54}{\$2.70} = \frac{54}{270} = \frac{1}{5}$

The ratio is $\frac{1}{5}$.

31. **Strategy** To find the ratio, write in simplest form the number of National Basketball Association rookies (45) over the number of college seniors playing basketball (3750).

Solution $\frac{45}{3750} = \frac{3}{250}$

The ratio is $\frac{3}{250}$.

Critical Thinking

33. No, the value of a ratio is not always less than 1. For example, a ratio of $8 to $4 is 2 to $1 = \frac{2}{1} = 2$ which is greater than 1.

Projects or Group Activities

35. Answers will vary.

Section 4.2

Concept Check

1. A ratio is a comparison of quantities with the same unit; a rate is a comparison of quantities with different units.

Objective A Exercises

3. $\frac{3 \text{ pounds}}{4 \text{ people}}$

5. $\frac{\$80}{12 \text{ boards}} = \frac{\$20}{3 \text{ boards}}$

7. $\frac{300 \text{ miles}}{15 \text{ gallons}} = \frac{20 \text{ miles}}{1 \text{ gallon}}$

9. $\frac{16 \text{ gallons}}{2 \text{ hours}} = \frac{8 \text{ gallons}}{1 \text{ hour}}$

11. Divide the number of gallons per minute by 60.

Objective B Exercises

13. 15 feet in 1 second

15. $\frac{10 \text{ feet}}{4 \text{ seconds}} = 2.5 \text{ feet / second}$

17. $\frac{\$3900}{4 \text{ weeks}} = \$975 / \text{ week}$

19. $\frac{1100 \text{ trees}}{10 \text{ acres}} = 110 \text{ trees/acre}$

21. $\frac{\$131.88}{7 \text{ hours}} = \$18.84 / \text{hour}$

23. $\frac{409.4 \text{ miles}}{11.5 \text{ gallons}} = 35.6 \text{ miles/gallon}$

25. $\frac{639 \text{ miles}}{15 \text{ gallons}} = 42.6 \text{ miles/gallon}$

Objective C Exercises

27. **Strategy** To find the number of miles per dollar, divide the total number of miles you get per gallon (26) by the cost per gallon ($3.49).

Solution $3.49\overline{)26.00}$ gives 7.44

You get 7.4 miles per dollar.

29. **Strategy** To find the number of rides per day in the first month, divide the number of rides (36,612) by the number of days (30).

Solution $30\overline{)36,612.0}$ gives 1220.4

During the first month, there were 1220 rides per day.

31. **Strategy** To find the advertiser's cost per viewer, divide the cost for the ad ($3 million) by the number of viewers (106 million).

Solution $106\overline{)3.000}$ gives 0.028

The cost per viewer is $.03.

33. **Strategy** To find the flow rate, divide the number of gallons (10) by the length of time (50 seconds, or $\frac{5}{6}$ minute).

Solution $10 \div \frac{5}{6} = \frac{\cancel{10}^{2}}{1} \times \frac{6}{\cancel{5}_{1}} = 12$

The pump dispenses gas at a rate of 12 gallons per minute.

35. **Strategy** To find the price of a car in yen, multiply the price ($34,000) by the Japanese yen exchange rate (79.8700 yen per U.S. dollar).

Solution $\frac{\$34,000}{1} \times \frac{79.8700 \text{ yen}}{\$1}$

$= 2{,}715{,}580 \text{ yen}$

The price of the car would be 2,715,580 yen.

37a. **Strategy** To find which country has the least population density, find the population density for each country by dividing the population of each country by the area of that country.

Solution Australia: $2{,}968{,}000\overline{)21{,}767{,}000.000}$ gives 7.333

India: $1{,}269{,}000\overline{)1{,}189{,}173{,}000.000}$ gives 937.094

United States: $3{,}619{,}000\overline{)311{,}051{,}000.000}$ gives 85.949

Australia has a population density of 7.33 people per square mile. India has a population density of 937.09 people per square mile. The United States has a population density of 85.95 people per square mile. Australia is the country with the least population density.

b. **Strategy** To find how many more people per square mile, use the results rounded to the nearest whole number from part a to subtract the population density of the United States (83) from the population density of India (890).

Solution

$$\begin{array}{r} 937 \\ -\,86 \\ \hline 851 \end{array}$$

There are 851 more people per square mile in India than in the United States.

Critical Thinking

39. The price–earnings ratio of a company's stock is computed by dividing the current price per share of the stock by the annual earnings per share. For example, if the price–earnings ratio of a company's stock is 8.5, the price of the stock is 8.5 times the earnings per share of the stock.

Projects or Group Activities

41. $\frac{100}{28} \approx 3.6$ gallons per 100 miles

43. $4 \div 1000 = 0.004$ ppm

Check Your Progress: Chapter 4

1. $\frac{12 \text{ minutes}}{48 \text{ minutes}} = \frac{1}{4}$

12 minutes : 48 minutes = 1 : 4

2. $\frac{24 \text{ pounds}}{36 \text{ pounds}} = \frac{2}{3}$

24 pounds : 36 pounds = 2 : 3

3. $\frac{25 \text{ miles}}{60 \text{ miles}} = \frac{5}{12}$

25 miles : 60 miles = 5 : 12

4. $\frac{\$96}{4 \text{ hours}} = \$24/\text{hour}$

5. $\frac{100 \text{ yards}}{9.6 \text{ seconds}} \approx 10.4$ yards/second

6. $\frac{525 \text{ miles}}{18 \text{ gallons}} \approx 29.2$ miles/gallon

7. **Strategy** To find the amount of fertilizer to use, divide the number of gallons (10) by the square footage (400 square feet).

Solution $\frac{10}{400} = 0.025$

Use 0.025 gallon per square feet.

8. **Strategy** To find the number of calories per ounce, divide the total number of calories (150) by the amount of milk (8 ounces).

Solution $\frac{150}{8} = 18.75$

There are 18.75 calories per ounce in whole milk.

9. **Strategy** To find the cost per rose, divide the total cost ($51) by the number of roses (1 dozen or 12).

Solution $\frac{51}{12} = 4.25$

The cost per rose is $4.25.

10. **Strategy** To find the cost per page, divide the cost of the cartridge ($85) by the number of pages it can print (2000).

Solution $\frac{85}{2000} = 0.0425$

It costs $.0425 per page to use this cartridge.

Section 4.3

Concept Check

1. $n = 45 \div 15$

3. $72 \div 9 = n$

Objective A Exercises

5.
$\frac{4}{8} \times \frac{10}{20} \rightarrow 8 \times 10 = 80$
$\rightarrow 4 \times 20 = 80$
The proportion is true.

7.
$\frac{7}{8} \times \frac{11}{12} \rightarrow 8 \times 11 = 88$
$\rightarrow 7 \times 12 = 84$
The proportion is not true.

9.
$\frac{27}{8} \times \frac{9}{4} \rightarrow 8 \times 9 = 72$
$\rightarrow 27 \times 4 = 108$
The proportion is not true.

11.
$\frac{45}{135} \times \frac{3}{9} \rightarrow 135 \times 3 = 405$
$\rightarrow 45 \times 9 = 405$
The proportion is true.

13.
$\frac{50}{2} \times \frac{25}{1} \rightarrow 2 \times 25 = 50$
$\rightarrow 50 \times 1 = 50$
The proportion is true.

15.
$\frac{6}{5} \times \frac{30}{25} \rightarrow 5 \times 30 = 150$
$\rightarrow 6 \times 25 = 150$
The proportion is true.

17.
$\frac{15}{4} \times \frac{45}{12} \rightarrow 4 \times 45 = 180$
$\rightarrow 15 \times 12 = 180$
The proportion is true.

19.
$\frac{300}{4} \times \frac{450}{7} \rightarrow 4 \times 450 = 1800$
$\rightarrow 300 \times 7 = 2100$
The proportion is not true.

21.
$\frac{65}{5} \times \frac{26}{2} \rightarrow 5 \times 26 = 130$
$\rightarrow 65 \times 2 = 130$
The proportion is true.

23. Yes

Objective B Exercises

25. Yes

27. $n \times 21 = 7 \times 9$
$n \times 21 = 63$
$n = 63 \div 21$
$n = 3$

29. $7 \times n = 21 \times 35$
$7 \times n = 735$
$n = 735 \div 7$
$n = 105$

31. $3 \times 10 = n \times 15$
$30 = n \times 15$
$30 \div 15 = n$
$2 = n$

33. $5 \times 144 = 12 \times n$
$720 = 12 \times n$
$720 \div 12 = n$
$60 = n$

35. $4 \times 5 = n \times 9$
$20 = n \times 9$
$20 \div 9 = n$
$2.22 \approx n$

37. $36 \times n = 20 \times 12$
$36 \times n = 240$
$n = 240 \div 36$
$n \approx 6.67$

39. $40 \times 8 = n \times 15$
$320 = n \times 15$
$320 \div 15 = n$
$21.33 \approx n$

41. $n \times 120 = 30 \times 65$
$n \times 120 = 1950$
$n = 1950 \div 120$
$n = 16.25$

43. $1.3 \times 30 = 16 \times n$
$39 = 16 \times n$
$39 \div 16 = n$
$2.44 \approx n$

45. $1.9 \times n = 7 \times 13$
$1.9 \times n = 91$
$n = 91 \div 1.9$
$n \approx 47.89$

Objective C Exercises

47. **Strategy** To find out how many calories are in a 0.5-ounce serving of cereal, write and solve a proportion using n to represent the calories.

Solution
$$\frac{6 \text{ ounces}}{600 \text{ calories}} = \frac{0.5 \text{ ounces}}{n \text{ calories}}$$
$6 \times n = 600 \times 0.5$
$6 \times n = 300$
$n = 300 \div 6$
$n = 50$

A 0.5-ounce serving contains 50 calories.

49. **Strategy** To find the number of miles a car will travel on 14 gallons of gas, write and solve a proportion using n to represent the number of miles.

Solution
$$\frac{70.5 \text{ miles}}{3 \text{ gallons}} = \frac{n \text{ miles}}{14 \text{ gallons}}$$
$70.5 \times 14 = 3 \times n$
$987 = 3 \times n$
$987 \div 3 = n$
$329 = n$

The car can travel 329 miles on 14 gallons of gas.

51. **Strategy** To find out how gallons of water are required, write and solve a proportion using n to represent the gallons of water.

Solution
$$\frac{1 \text{ gallon}}{2 \text{ ounces}} = \frac{n \text{ gallons}}{25 \text{ ounces}}$$
$1 \times 25 = 2 \times n$
$25 = 2 \times n$
$25 \div 2 = n$
$12.5 = n$

12.5 gallons of water are required.

53. **Strategy** To find the distance between two cities that are 2 inches apart on the map, write and solve a proportion using n to represent the number of miles.

Solution
$$\frac{1.25 \text{ inches}}{10 \text{ miles}} = \frac{2 \text{ inches}}{n \text{ miles}}$$
$1.25 \times n = 10 \times 2$
$1.25 \times n = 20$
$n = 20 \div 1.25$
$n = 16$

The distance is 16 miles.

55. **Strategy** To find the dosage for a person who weighs 150 pounds, write and solve a proportion using n to represent the number of ounces.

Solution

$$\frac{n}{150 \text{ pounds}} = \frac{\frac{1}{3} \text{ ounce}}{40 \text{ pounds}}$$

$$40 \times n = \frac{1}{3} \times 150$$

$$40 \times n = 50$$

$$n = 50 \div 40$$

$$n = 1.25$$

1.25 ounces are required.

57. Strategy To find how many people in a county of 240,000 eligible voters would vote in the election, write and solve a proportion using n to represent the number of voters.

Solution

$$\frac{n}{240,000} = \frac{2}{3}$$

$$2 \times 240,000 = 3 \times n$$

$$480,000 = 3 \times n$$

$$480,000 \div 3 = n$$

$$160,000 = n$$

160,000 people would vote.

59. Strategy To find the monthly payment, write and solve a proportion using n to represent the monthly payment.

Solution

$$\frac{\$35.35}{\$10,000} = \frac{n}{\$50,000}$$

$$35.35 \times 50,000 = 10,000 \times n$$

$$1,767,500 = 10,000 \times n$$

$$1,767,500 \div 10,000 = n$$

$$176.75 = n$$

The monthly payment is $176.75.

61. Strategy To find how many defects would be expected from a run of 25,000 circuit boards, write and solve a proportion using n to represent the number of defective circuit boards.

Solution

$$\frac{60 \text{ defective}}{2000 \text{ boards}} = \frac{n}{25,000 \text{ boards}}$$

$$60 \times 25,000 = 2000 \times n$$

$$1,500,000 = 2000 \times n$$

$$1,500,000 \div 2000 = n$$

$$750 = n$$

750 defective boards can be expected.

63. Strategy To find how much a bowling ball weighs on the moon, write and solve a proportion using n to represent the weight on the moon.

Solution

$$\frac{1}{6} = \frac{n}{16}$$

$$1 \times 16 = n \times 6$$

$$16 = n \times 6$$

$$16 \div 6 = n$$

$$2.67 = n$$

The bowling ball would weigh 2.67 pounds on the moon.

65. Strategy To find what dividend Carlos would receive after purchasing additional shares:

- Find the total number of shares owned by adding the original number (50) to the number purchased (300).
- Find the dividend by writing and solving a proportion using n to represent the dividend.

Solution
$$\begin{array}{r} 300 \\ +\ 50 \\ \hline 350 \text{ shares} \end{array}$$

$$\frac{n}{350 \text{ shares}} = \frac{\$153}{50 \text{ shares}}$$
$$153 \times 350 = n \times 50$$
$$53{,}550 = n \times 50$$
$$53{,}550 \div 50 = n$$
$$1071 = n$$

The dividend would be \$1071.

Critical Thinking

67. The fact that the number of workers per retiree is decreasing means that for each retiree drawing money out of Social Security, there are fewer and fewer workers paying into the Social Security system. In other words, fewer workers are supporting each retiree. Therefore, unless the amount paid into the system by each worker is increased or other radical changes are made, the funds to pay the Social Security benefits will be depleted.

Projects or Group Activities

69. No; more slowly

Chapter 4 Review Exercises

1.
$$\frac{2}{9} \times \frac{10}{45} \quad \begin{array}{l} 10 \to 9 \times 10 = 90 \\ 45 \to 2 \times 45 = 90 \end{array}$$
The proportion is true.

2. $\frac{\$32}{\$80} = \frac{32}{80} = \frac{2}{5}$
$\$32 : \$80 = 32 : 80 = 2 : 5$
\$32 to \$80 = 32 to 80 = 2 to 5

3. $\frac{250 \text{ miles}}{4 \text{ hours}} = 62.5 \text{ miles/hour}$

4.
$$\frac{8}{15} \times \frac{32}{60} \quad \begin{array}{l} 32 \to 15 \times 32 = 480 \\ 60 \to 8 \times 60 = 480 \end{array}$$
The proportion is true.

5. $\frac{16}{n} = \frac{4}{17}$
$16 \times 17 = n \times 4$
$272 = n \times 4$
$272 \div 4 = n$
$68 = n$

6. $\frac{\$500}{40 \text{ hours}} = \$12.50/\text{hour}$

7. $\frac{\$8.75}{5 \text{ pounds}} = \$1.75/\text{pound}$

8. $\frac{8 \text{ feet}}{28 \text{ feet}} = \frac{8}{28} = \frac{2}{7}$
8 feet:28 feet = 8 : 28 = 2 : 7
8 feet to 28 feet = 8 to 28 = 2 to 7

9. $\frac{n}{8} = \frac{9}{2}$
$n \times 2 = 8 \times 9$
$n \times 2 = 72$
$n = 72 \div 2$
$n = 36$

10. $\frac{18}{35} = \frac{10}{n}$
$n \times 18 = 35 \times 10$
$n \times 18 = 350$
$n = 350 \div 18$
$n \approx 19.44$

11. $\frac{6 \text{ inches}}{15 \text{ inches}} = \frac{6}{15} = \frac{2}{5}$
6 inches:15 inches = 6:15 = 2:5
6 inches to 15 inches = 6 to 15 = 2 to 5

12.
$$\frac{3}{8} \times \frac{10}{24} \quad \begin{array}{l} 10 \to 8 \times 10 = 80 \\ 24 \to 3 \times 24 = 72 \end{array}$$
The proportion is not true.

13. $\frac{\$35}{4 \text{ hours}}$

14. $\dfrac{326.4 \text{ miles}}{12 \text{ gallons}} = 27.2 \text{ miles/gallon}$

15. $\dfrac{12 \text{ days}}{12 \text{ days}} = \dfrac{12}{12} = \dfrac{1}{1}$

12 days:12 days = 12:12 = 1:1

12 days to 12 days = 12 to 12 = 1 to 1

16.

$\dfrac{5}{7} \times \dfrac{25}{35} \rightarrow 7 \times 25 = 175$

$\dfrac{5}{7} \times \dfrac{25}{35} \rightarrow 5 \times 35 = 175$

The proportion is true.

17.
$$\frac{24}{11} = \frac{n}{30}$$
$$24 \times 30 = n \times 11$$
$$720 = n \times 11$$
$$720 \div 11 = n$$
$$65.45 \approx n$$

18. $\dfrac{100 \text{ miles}}{3 \text{ hours}}$

19. **Strategy** To find the ratio:

• Find the amount of the decrease by subtracting the current price ($48) from the original price ($80).

• Write the ratio between the decrease and the original price.

Solution
$$\begin{array}{r} 80 \\ -\ 48 \\ \hline 32 \end{array}$$
$$\frac{\$32}{\$80} = \frac{32}{80} = \frac{2}{5}$$

The ratio is $\dfrac{2}{5}$.

20. **Strategy** To find the property tax on a home valued at $320,000, write and solve a proportion using n to represent the property tax.

Solution
$$\frac{n}{\$320,000} = \frac{\$4900}{\$245,000}$$
$$4900 \times 320,000 = 245,000 \times n$$
$$1,568,000,000 = 245,000 \times n$$
$$\frac{1,568,000,000}{245,000} = n$$
$$6400 = n$$

The property tax is $6400.

21. **Strategy** To find the ratio, write the ratio of the amount Rita received ($900) to the cost ($2400).

Solution
$$\frac{\$900}{\$2400} = \frac{900}{2400} = \frac{3}{8}$$

The ratio is $\dfrac{3}{8}$.

22. **Strategy** To find the cost per phone of the phones that did pass inspection:

• Find the number of phones that did pass inspection by subtracting the number that did not pass inspection (24) from the total (1000).

• Divide the total manufacturing cost ($36,600) by the number of phones that did pass inspection.

Solution
$$\begin{array}{r} 1000 \\ -\ 24 \\ \hline 976 \end{array}$$
$$976\overline{)36,600}\quad 37.50$$

The cost per phone was $37.50.

23. **Strategy** To find how many concrete blocks would be needed to build a wall 120 feet long, write and solve a proportion

using n to represent the number of concrete blocks.

Solution

$$\frac{n}{120 \text{ feet}} = \frac{448 \text{ concrete blocks}}{40 \text{ feet}}$$
$$n \times 40 = 120 \times 448$$
$$n \times 40 = 53,760$$
$$n = 53,760 \div 40$$
$$n = 1344$$

1344 blocks would be needed.

24. Strategy To find the ratio, write a ratio of radio advertising ($30,000) to newspaper advertising ($12,000).

Solution

$$\frac{\$30,000}{\$12,000} = \frac{30,000}{12,000} = \frac{5}{2}$$

The ratio is $\frac{5}{2}$.

25. Strategy To find the cost per pound, divide the total cost ($13.95) by the number of pounds (15).

Solution

$$15\overline{)13.95}\quad 0.93$$

The turkey costs $.93/pound.

26. Strategy To find the average number of miles driven per hour, divide the total number of miles driven (198.8) by the number of hours (3.5).

Solution

$$3.5\overline{)198.8}\quad 56.8$$

The average was 56.8 miles/hour.

27. Strategy To find the cost of $50,000 of insurance, write and solve a proportion using n to represent the cost.

Solution

$$\frac{n}{\$50,000} = \frac{\$9.87}{\$1000}$$
$$n \times 1000 = 9.87 \times 50,000$$
$$n \times 1000 = 493,500$$
$$n = 493,500 \div 1000$$
$$n = 493.50$$

The cost is $493.50.

28. Strategy To find the cost per share, divide the total cost ($3580) by the number of shares (80).

Solution

$$80\overline{)3580}\quad 44.75$$

The cost is $44.75/share.

29. Strategy To find how many pounds of fertilizer are used on a lawn that measures 3000 square feet, write and solve a proportion using n to represent the number of pounds of fertilizer.

Solution

$$\frac{n}{3000 \text{ square feet}} = \frac{1.5 \text{ pounds}}{200 \text{ square feet}}$$
$$n \times 200 = 1.5 \times 3000$$
$$n \times 200 = 4500$$
$$n = 4500 \div 200$$
$$n = 22.5$$

22.5 pounds of fertilizer will be used.

30. Strategy To find the ratio:

- Find the amount of the increase by subtracting the original value ($160,000) from the increased value ($240,000).
- Write the ratio of the amount of the increase to the original value ($160,000).

Solution
$$240{,}000 - 160{,}000 = 80{,}000$$
$$\frac{\$80{,}000}{\$160{,}000} = \frac{80{,}000}{160{,}000} = \frac{1}{2}$$

The ratio is $\frac{1}{2}$.

Chapter 4 Test

1. $\frac{\$46{,}036.80}{12 \text{ months}} = \$3836.40/\text{month}$

2. $\frac{40 \text{ miles}}{240 \text{ miles}} = \frac{40}{240} = \frac{1}{6}$

40 miles : 240 miles = 40 : 240 = 1 : 6
40 miles to 240 miles = 40 to 240 = 1 to 6

3. $\frac{18 \text{ supports}}{8 \text{ feet}} = \frac{9 \text{ supports}}{4 \text{ feet}}$

4.
$\frac{40}{125} \times \frac{5}{25}$ → $125 \times 5 = 625$, $40 \times 25 = 1000$
The proportion is not true.

5. $\frac{12 \text{ days}}{4 \text{ days}} = \frac{12}{4} = \frac{3}{1}$

12 days : 4 days = 12 : 4 = 3 : 1
12 days to 4 days = 12 to 4 = 3 to 1

6. $\frac{5}{12} = \frac{60}{n}$
$n \times 5 = 12 \times 60$
$n \times 5 = 720$
$n = 720 \div 5$
$n = 144$

7. $\frac{256.2 \text{ miles}}{8.4 \text{ gallons}} = 30.5 \text{ miles/gallon}$

8. $\frac{\$27}{\$81} = \frac{27}{81} = \frac{1}{3}$
\$27 : \$81 = 27 : 81 = 1 : 3
\$27 to \$81 = 27 to 81 = 1 to 3

9.
$\frac{5}{14} \times \frac{25}{70}$ → $14 \times 25 = 350$, $5 \times 70 = 350$
The proportion is true.

10. $\frac{n}{18} = \frac{9}{4}$
$n \times 4 = 9 \times 18$
$n \times 4 = 162$
$n = 162 \div 4$
$n = 40.5$

11. $\frac{9 \text{ feet}}{6 \text{ boards}} = \frac{3 \text{ feet}}{2 \text{ boards}}$

12. $\frac{18 \text{ feet}}{30 \text{ feet}} = \frac{18}{30} = \frac{3}{5}$
18 feet : 30 feet = 18 : 30 = 3 : 5
18 feet to 30 feet = 18 to 30 = 3 to 5

13. **Strategy** To find the dividend on 500 shares of the utility stock, write and solve a proportion using n to represent the dividend.

Solution
$$\frac{n}{500 \text{ shares}} = \frac{\$62.50}{50 \text{ shares}}$$
$$n \times 50 = 500 \times \$62.50$$
$$n \times 50 = 31{,}250$$
$$n = 31{,}250 \div 50$$
$$n = 625$$

The dividend is \$625.

14. **Strategy** To find the ratio, write the ratio of turns in the primary coil (40) to the number of turns in the secondary coil (480) in simplest form.

Solution
$$\frac{40}{480} = \frac{1}{12}$$

The ratio is $\frac{1}{12}$.

15. $\frac{2421 \text{ miles}}{4.5 \text{ hours}} = 538 \text{ miles/hour}$

The plane's speed is 538 miles/hour.

16. Strategy To estimate the number of pounds of water in a college student weighing 150 pounds, write and solve a proportion using n to represent the number of pounds of water.

Solution

$$\frac{88 \text{ pounds water}}{\left(\begin{array}{c}100 \text{ pounds}\\ \text{body weight}\end{array}\right)} = \frac{n}{\left(\begin{array}{c}150 \text{ pounds}\\ \text{body weight}\end{array}\right)}$$

$$88 \times 150 = n \times 100$$
$$13,200 = n \times 100$$
$$13,200 \div 100 = n$$
$$132 = n$$

The college student's body contains 132 pounds of water.

17. $\dfrac{\$69.20}{40 \text{ feet}} = \$1.73/\text{foot}$

The cost of the lumber is $1.73/foot.

18. Strategy To find how many ounces of medication are required for a person who weighs 175 pounds, write and solve a proportion using n to represent the ounces of medication.

Solution

$$\frac{\frac{1}{4} \text{ ounce}}{50 \text{ pounds}} = \frac{n}{175 \text{ pounds}}$$

$$\frac{1}{4} \times 175 = n \times 50$$
$$43.75 = n \times 50$$
$$43.75 \div 50 = n$$
$$0.875 = n$$

The amount of medication required is 0.875 ounce.

19. Strategy To find the ratio of the number of games won to the total number of games played, add the number of games won (20) to the number of games lost (5) to determine the number of games played. Then write the ratio of the number of games won to the number of games played.

Solution 20 + 5 = 25 games played

$$\frac{20}{25} = \frac{4}{5}$$

The ratio of the number of games won to the total number of games played is $\frac{4}{5}$.

20. Strategy To find the number of defective hard drives in the production of 1200 hard drives, write and solve a proportion using n to represent the number of defective hard drives.

Solution

$$\frac{n}{1200} = \frac{3}{100}$$
$$n \times 100 = 1200 \times 3$$
$$n \times 100 = 3600$$
$$n = 3600 \div 100$$
$$n = 36$$

36 defective hard drives are expected to be found in the production of 1200 hard drives.

Cumulative Review Exercises

1.

$$\begin{array}{r} \scriptstyle 9 \\ \scriptstyle 1\,10\;\;10\,8\,15 \\ \not{2}\,\not{0},\not{0}\,\not{9}\,\not{5} \\ -10,937 \\ \hline 9,158 \end{array}$$

2. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 3 = 2^4 \cdot 3^3$

3.

$$\begin{aligned} 4-(5-2)^2 \div 3+2 &= 4-(-3)^2 \div 3+2 \\ &= 4-9 \div 3+2 \\ &= 4-3+2 \\ &= 1+2=3 \end{aligned}$$

4.

2	80
2	40
2	20
2	10
2	5
5	1

$160 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5$

5.

	2	3
9 =		$3 \cdot 3$
12 =	$2 \cdot 2$	3
18 =	2	$3 \cdot 3$

$\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 3 = 36$

6.

	2	3	7
28 =	$2 \cdot 2$		7
42 =	2	3	7

$\text{GCF} = 2 \cdot 7 = 14$

7. $\dfrac{40}{64} = \dfrac{\overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot 5}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 2 \cdot 2 \cdot 2} = \dfrac{5}{8}$

8.
$$3\frac{5}{6} = 3\frac{25}{30}$$
$$+\,4\frac{7}{15} = 4\frac{14}{30}$$
$$7\frac{39}{30} = 8\frac{9}{30} = 8\frac{3}{10}$$

9.
$$10\frac{1}{6} = 10\frac{3}{18} = 9\frac{21}{18}$$
$$-\,4\frac{5}{9} = 4\frac{10}{18} = 4\frac{10}{18}$$
$$5\frac{11}{18}$$

10.
$$\frac{11}{12} \times 3\frac{1}{11} = \frac{11}{12} \times \frac{34}{11}$$
$$= \frac{11 \times 34}{12 \times 11}$$
$$= \frac{\overset{1}{\cancel{11}} \cdot \overset{1}{2} \cdot 17}{2 \cdot \underset{1}{2} \cdot 3 \cdot \underset{1}{\cancel{11}}} = \frac{17}{6} = 2\frac{5}{6}$$

11.
$$3\frac{1}{3} \div \frac{5}{7} = \frac{10}{3} \div \frac{5}{7}$$
$$= \frac{10}{3} \times \frac{7}{5}$$
$$= \frac{10 \cdot 7}{3 \cdot 5} = \frac{2 \cdot \overset{1}{\cancel{5}} \cdot 7}{3 \cdot \underset{1}{\cancel{5}}} = \frac{14}{3} = 4\frac{2}{3}$$

12.
$$\left(\frac{2}{5} + \frac{3}{4}\right) \div \frac{3}{2} = \left(\frac{8}{20} + \frac{15}{20}\right) \div \frac{3}{2}$$
$$= \frac{23}{20} \times \frac{2}{3}$$
$$= \frac{23 \times 2}{20 \times 3} = \frac{23 \cdot \overset{1}{\cancel{2}}}{2 \cdot \underset{1}{\cancel{2}} \cdot 5 \cdot 2} = \frac{23}{30}$$

13. Four and seven hundred nine ten-thousandths

14.
Given place value
2.09762
$7 > 5$
2.09762 rounded to the nearest hundredth is 2.10.

15.
$$1.9898 \approx 1.990$$
$$8.09\overset{\frown}{)}16.09.7600$$
$$-\ 809$$
$$8007$$
$$-7281$$
$$7266$$
$$-6472$$
$$7940$$
$$-7281$$
$$6590$$
$$-6472$$
$$118$$

16. $0.06 = \dfrac{6}{100} = \dfrac{3}{50}$

17. $\dfrac{25 \text{ miles}}{200 \text{ miles}} = \dfrac{25}{200} = \dfrac{1}{8}$

18. $\dfrac{87¢}{6 \text{ pencils}} = \dfrac{29¢}{2 \text{ pencils}}$

19. $\dfrac{250.5 \text{ miles}}{7.5 \text{ gallons of gas}} = 33.4 \text{ miles/gallon}$

20. $\frac{40}{n} = \frac{160}{17}$

$40 \times 17 = n \times 160$

$680 = n \times 160$

$680 \div 160 = n$

$4.25 = n$

21. $\frac{457.6 \text{ miles}}{8 \text{ hours}} = 57.2 \text{ miles/hour}$

The car's speed is 57.2 miles/hour.

22. $\frac{12}{5} = \frac{n}{15}$

$12 \times 15 = n \times 5$

$180 = n \times 5$

$180 \div 5 = n$

$36 = n$

23. **Strategy** To find your new checking account balance:

• Find the total of the checks written by adding the two checks ($192 and $88).

• Subtract the total of the checks written from the original balance ($1024).

Solution

$$\begin{array}{r} 192 \\ +\ 88 \\ \hline 280 \end{array} \qquad \begin{array}{r} 1024 \\ -\ 280 \\ \hline 744 \end{array}$$

Your new balance is $744.

24. **Strategy** To find the monthly payment:

• Find the amount to be paid by subtracting the down payment ($5000) from the original cost ($32,360).

• Divide the amount remaining to be paid by the number of payments (48).

Solution

$$\begin{array}{r} 32,360 \\ -\ 5,000 \\ \hline 27,360 \end{array} \qquad 48\overline{)27,360} \quad 570$$

The monthly payment is $570.

25. **Strategy** To find how many pages remain to be read:

• Find the number read during vacation by multiplying the total (175 pages) by $\frac{2}{5}$.

• Subtract the number of pages read during vacation from the total (175 pages).

Solution

$\frac{2}{5} \times 175 = \frac{2}{5} \times \frac{175}{1} = 70$

$175 - 70 = 105$

105 pages remain to be read.

26. **Strategy** To find the cost per acre, divide the total cost ($84,000) by the number of acres $\left(2\frac{1}{3}\right)$.

Solution

$84,000 \div 2\frac{1}{3} = 84,000 \div$

$= 84,000 \times$

$= 36,000$

The cost per acre was $36,000.

27. **Strategy** To find the amount of change:

• Find the total amount of the purchases by adding the two purchases ($45.58

and \$19.18).

• Subtract the total amount of the purchases from \$100.

Solution

$$\begin{array}{r} 45.58 \\ +\ 19.18 \\ \hline 64.76 \end{array} \qquad \begin{array}{r} 100.00 \\ -\ 64.76 \\ \hline 35.24 \end{array}$$

The change was \$35.24.

28. Strategy To find your monthly salary, divide your annual salary (\$41,691) by 12 months.

Solution

$$\begin{array}{r} 3468.25 \\ 12\overline{)41,619.00} \\ \underline{-36} \\ 56 \\ \underline{-48} \\ 81 \\ \underline{-72} \\ 99 \\ \underline{-96} \\ 30 \\ \underline{-24} \\ 60 \\ \underline{-60} \\ 0 \end{array}$$

Your monthly salary is \$3468.25.

29. Strategy To find how many inches will be eroded in 50 months, write and solve a proportion using n to represent the number of inches.

Solution

$$\frac{3 \text{ inches}}{6 \text{ months}} = \frac{n}{50 \text{ months}}$$

$$3 \times 50 = n \times 6$$

$$150 = n \times 6$$

$$150 \div 6 = n$$

$$25 = n$$

25 inches will erode in 50 months.

30. Strategy To find how many ounces of medication are required for a person who weighs 160 pounds, write and solve a proportion using n to represent the number of ounces.

Solution

$$\frac{n}{160} = \frac{\frac{1}{2} \text{ ounce}}{50 \text{ pounds}}$$

$$n \times 50 = \frac{1}{2} \times 160$$

$$n \times 50 = 80$$

$$n = 80 \div 50$$

$$n = 1.6$$

1.6 ounces of medication are required.

Chapter 5: Percents

Prep Test

1. $19 \times \frac{1}{100} = \frac{19}{100}$

2. $23 \times 0.01 = 0.23$

3. $0.47 \times 100 = 47$

4. $0.06 \times 47{,}500 = 2850$

5.

$$
\begin{array}{r}
4000. \\
0.015\overline{)60.000.} \\
-60 \\
\hline
00 \\
-0 \\
\hline
00 \\
-0 \\
\hline
0
\end{array}
$$

6. $8 \div \frac{1}{4} = \frac{8}{1} \times \frac{4}{1} = 32$

7. $\frac{5}{8} \times \frac{100}{1} = \frac{5 \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot 5 \cdot 5}{\underset{1}{2} \cdot \underset{1}{2} \cdot 2} = \frac{125}{2} = 62\frac{1}{2} = 62.5$

8. $\frac{200}{3} = 66\frac{2}{3}$

9. $16\overline{)28.00}$ $\quad 1.75$

Section 5.1

Objective A Exercises

1. 100

3. Left

Objective A Exercises

5. $72\% = 72 \times 0.01 = 0.72$

$72\% = 72 \times \frac{1}{100} = \frac{72}{100} = \frac{18}{25}$

7. $23\% = 23 \times 0.01 = 0.23$

$23\% = 23 \times \frac{1}{100} = \frac{23}{100}$

9. $36\% = 36 \times 0.01 = 0.36$

$36\% = 36 \times \frac{1}{100} = \frac{36}{100} = \frac{9}{25}$

11. $59\% = 59 \times 0.01 = 0.59$

$59\% = 59 \times \frac{1}{100} = \frac{59}{100}$

13. $41\% = 41 \times 0.01 = 0.41$

$41\% = 41 \times \frac{1}{100} = \frac{41}{100}$

15. $25.4\% = 25.4 \times 0.01 = 0.254$

$25.4\% = 25.4 \times \frac{1}{100} = \frac{25.4}{100} = \frac{254}{1000} = \frac{127}{500}$

17. $57.9\% = 57.9 \times 0.01 = 0.579$

$57.9\% = 57.9 \times \frac{1}{100} = \frac{57.9}{100} = \frac{579}{1000}$

19. $6.2\% = 6.2 \times 0.01 = 0.062$

$6.2\% = 6.2 \times \frac{1}{100} = \frac{6.2}{100} = \frac{62}{1000} = \frac{31}{500}$

21. $6.4\% = 6.4 \times 0.01 = 0.064$

$6.4\% = 6.4 \times \frac{1}{100} = \frac{6.4}{100} = \frac{64}{1000} = \frac{8}{125}$

23. $0.25\% = 0.25 \times 0.01 = 0.0025$

$0.25\% = 0.25 \times \frac{1}{100} = \frac{0.25}{100} = \frac{25}{10{,}000} = \frac{1}{400}$

25. $0.55\% = 0.55 \times 0.01 = 0.0055$

$0.55\% = 0.55 \times \frac{1}{100} = \frac{0.55}{100}$

$= \frac{55}{10{,}000} = \frac{11}{2000}$

27. $66\frac{2}{3}\% = 66\frac{2}{3} \times \frac{1}{100} = \frac{200}{3} \times \frac{1}{100}$
$= \frac{200}{300} = \frac{2}{3}$

29. $83\frac{1}{3}\% = 83\frac{1}{3} \times \frac{1}{100} = \frac{250}{3} \times \frac{1}{100}$
$= \frac{250}{300} = \frac{5}{6}$

31. $11\frac{1}{9}\% = 11\frac{1}{9} \times \frac{1}{100} = \frac{100}{9} \times \frac{1}{100}$
$= \frac{100}{900} = \frac{1}{9}$

33. $45\frac{5}{11}\% = 45\frac{5}{11} \times \frac{1}{100} = \frac{500}{11} \times \frac{1}{100}$
$= \frac{500}{1100} = \frac{5}{11}$

35. $4\frac{2}{7}\% = 4\frac{2}{7} \times \frac{1}{100} = \frac{30}{7} \times \frac{1}{100}$
$= \frac{30}{700} = \frac{3}{70}$

37. $6\frac{2}{3}\% = 6\frac{2}{3} \times \frac{1}{100} = \frac{20}{3} \times \frac{1}{100} = \frac{20}{300} = \frac{1}{15}$

39. Greater than

Objective B Exercises

41. 0.73 = 0.73 × 100% = 73%

43. 0.01 = 0.01 × 100% = 1%

45. 2.94 = 2.94 × 100% = 294%

47. 0.006 = 0.006 × 100% = 0.6%

49. 3.106 = 3.106 × 100% = 310.6%

51. 0.70 = 0.70 × 100% = 70%

53. $\frac{17}{20} = \frac{17}{20} \times 100\% = \frac{1700}{20}\% = 85\%$

55. $\frac{2}{5} = \frac{2}{5} \times 100\% = \frac{200}{5}\% = 40\%$

57. $\frac{1}{8} = \frac{1}{8} \times 100\% = \frac{100}{8}\% = 12.5\%$

59. $1\frac{1}{2} = 1\frac{1}{2} \times 100\% = \frac{3}{2} \times 100\%$
$= \frac{300}{2}\% = 150\%$

61. $\frac{9}{4} = \frac{9}{4} \times 100\% = \frac{900}{4}\% = 225\%$

63. $\frac{7}{8} = \frac{7}{8} \times 100\% = \frac{700}{8}\% = 87.5\%$

65. $\frac{12}{25} = \frac{12}{25} \times 100\% = \frac{1200}{25}\% = 48\%$

67. $\frac{4}{9} = \frac{4}{9} \times 100\% = \frac{400}{9}\% = 44\frac{4}{9}\%$

69. $1\frac{2}{3} = 1\frac{2}{3} \times 100\% = \frac{5}{3} \times 100\%$
$= \frac{500}{3}\% = 166\frac{2}{3}\%$

71. $\frac{7}{18} = \frac{7}{18} \times 100\% = \frac{700}{18}\% = 38\frac{8}{9}\%$

73. Less than

Critical Thinking

75. **Strategy** To find the percent of those surveyed that did not name corn, cole slaw, corn bread, or fries:

- Add the percents representing these four side dishes.
- Subtract the sum from 100%.

Solution

38% Corn on the Cob
35% Cole slaw
11% Corn bread
10% Fries
94%

100% – 94% = 6%

6% of those surveyed named something other than corn on the cob, cole slaw, corn bread, or fries.

Projects or Group Activities

77. $\frac{53}{1000} = 0.053$

79. $\frac{150}{1000} = \frac{3}{20} = 0.15$

81. 0.5%

83. 62.5%

Section 5.2

Concept Check

1. Percent $\times$ base = amount

3. Greater than

Objective A Exercises

5. $0.08 \times 100 = n$
$8 = n$

7. $0.27 \times 40 = n$
$10.8 = n$

9. $0.0005 \times 150 = n$
$0.075 = n$

11. $1.25 \times 64 = n$
$80 = n$

13. $0.107 \times 485 = n$
$51.895 = n$

15. $0.0025 \times 3000 = n$
$7.5 = n$

17. $0.80 \times 16.25 = n$
$13 = n$

19. $0.015 \times 250 = n$
$3.75 = n$

21. $\frac{1}{6} \times 120 = n$
$20 = n$

23. $0.05 \times 95 = n$ or $0.75 \times 6 = n$
$4.75 = n$ $4.5 = n$

Because 4.75 > 4.5, 5% of 95 is larger.

25. $0.79 \times 16 = n$ or $0.20 \times 65 = n$
$12.64 = n$ $13 = n$

Because 12.64 < 13, 79% of 16 is smaller.

27. Less than

Objective B Exercises

29. Less than

31. **Strategy** To find how many more domestic airline passengers there will be in 2020, write and solve the basic percent equation using n to represent the increase in the number of passengers. The percent is 22% and the base is 629.5 million.

Solution
$$22\% \times 629.5 = n$$
$$0.22 \times 629.5 = n$$
$$138.49 = n$$

138.49 million more passengers will fly domestic airlines.

33. **Strategy** To find the number of grams of gold, silver, and copper in the item, write and solve the basic percent equation using g to represent the amount of gold, s to represent the amount of silver, and c to represent the amount of copper. The percents are 58.5% gold, 17.5% silver, and 24% copper; the base is 50 grams.

Solution Gold:
$$58.5\% \times 50 = g$$
$$0.585 \times 50 = g$$
$$29.25 = g$$

Silver:
$$17.5\% \times 50 = s$$
$$0.175 \times 50 = s$$
$$8.75 = s$$

Copper:
$$24\% \times 50 = c$$
$$0.24 \times 50 = c$$
$$12 = c$$

The item contains 29.25 grams of gold, 8.75 grams of silver, and 12 grams of copper.

35. **Strategy** To find the number of tax returns filed electronically, write and solve the basic percent equation using n to represent the number of electronic returns. The percent is 69.8% and the base is 141.5 million.

Solution
$$69.8\% \times 141.5 = n$$
$$0.698 \times 141.5 = n$$
$$98.767 = n$$

Approximately 99 million returns were filed electronically.

37. **Strategy** To find the monthly payment:

- Find the sales tax by writing and solving the basic percent equation using n as the sales tax. The percent is 6.75% and the base is \$28,995.
- Add the sales tax to the purchase price of the car (\$28,995).
- Divide the result by the number of monthly payments (48).

Solution
$$6.75\% \times 28{,}995 = n$$
$$0.0675 \times 28{,}995 = n$$
$$1957.1625 = n$$
$$1957.16 \approx n$$

$$\begin{array}{r} 28{,}995 \\ +\ 1957.16 \\ \hline 30{,}952.16 \end{array}$$

$$48\overline{)30{,}952.160}\quad 644.836$$

The total cost of the car is

$30,952.16 and the monthly payment is $644.84.

Projects or Group Activities

39. $0

41. $\$327.40 + 28\% \times (\$2542 - \$1648)$
$= 327.40 + 0.28(2542 - 1648)$
$= 327.40 + 0.28(894)$
$= 327.40 + 250.32$
$= \$577.72$

43. $\$91.40 + 25\% \times (\$1648 - \$704)$
$= 91.40 + 0.25(1648 - 704)$
$= 91.40 + 236$
$= \$327.40$
No, there is no difference.

Check Your Progress: Chapter 5

1. $85\% = 85 \times 0.01 = 0.85$
$85\% = 85 \times \frac{1}{100} = \frac{85}{100} = \frac{17}{20}$

2. $4\% = 4 \times 0.01 = 0.04$
$4\% = 4 \times \frac{1}{100} = \frac{4}{100} = \frac{1}{25}$

3. $0.25\% = 0.25 \times 0.01 = 0.0025$
$0.25\% = 0.25 \times \frac{1}{100} = \frac{0.25}{100} = \frac{25}{10,000} = \frac{1}{400}$

4. $180\% = 180 \times 0.01 = 1.80$
$180\% = 180 \times \frac{1}{100} = \frac{180}{100} = \frac{9}{5} = 1\frac{4}{5}$

5. $0.15 = 0.15 \times 100\% = 15\%$

6. $0.027 = 0.027 \times 100\% = 2.7\%$

7. $1.45 = 1.45 \times 100\% = 145\%$

8. $0.00125 = 0.00125 \times 100\% = 0.125\%$

9. $\frac{3}{5} = \frac{3}{5} \times 100\% = \frac{300}{5}\% = 60\%$

10. $\frac{17}{40} = \frac{17}{40} \times 100\% = \frac{1700}{40}\% = 42.5\%$

11. $\frac{25}{60} = \frac{25}{60} \times 100\% = \frac{2500}{60}\% = 41\frac{2}{3}\%$

12. $\frac{85}{50} = \frac{85}{50} \times 100\% = \frac{8500}{50}\% = 170\%$

13. $35\% \times 84 = n$
$0.35 \times 84 = n$
$29.4 = n$

14. $5.5\% \times 250 = n$
$0.055 \times 250 = n$
$13.75 = n$

15. $33\% \times 120 = n$
$0.33 \times 120 = n$
$39.6 = n$

16. $0.2\% \times 78 = n$
$0.002 \times 78 = n$
$0.156 = n$

17. **Strategy** To find the increase in pay, write and solve the basic percent equation using n to represent the pay increase. The percent is 5% and the base is $1445.

Solution $5\% \times 1445 = n$
$0.05 \times 1445 = n$
$72.25 = n$
The officer's weekly pay increased by $72.25.

Section 5.3

Concept Check

1. Greater than

3. Greater than

Objective A Exercises

5. $n \times 75 = 24$
$n = 24 \div 75$
$n = 0.32$
$n = 32\%$

7. $n \times 90 = 15$
$n = 15 \div 90$
$n = 0.16\frac{2}{3}$
$n = 16\frac{2}{3}\%$

9. $n \times 12 = 24$
$n = 24 \div 12$
$n = 2$
$n = 200\%$

11. $n \times 16 = 6$
$n = 6 \div 16$
$n = 0.375$
$n = 37.5\%$

13. $n \times 100 = 18$
$n = 18 \div 100$
$n = 0.18$
$n = 18\%$

15. $n \times 2000 = 5$
$n = 5 \div 2000$
$n = 0.0025$
$n = 0.25\%$

17. $n \times 6 = 1.2$
$n = 1.2 \div 6$
$n = 0.2$
$n = 20\%$

19. $n \times 4.1 = 16.4$
$n = 16.4 \div 4.1$
$n = 4$
$n = 400\%$

21. $n \times 40 = 1$
$n = 1 \div 40$
$n = 0.025$
$n = 2.5\%$

23. $n \times 48 = 18$
$n = 18 \div 48$
$n = 0.375$
$n = 37.5\%$

25. $n \times 2800 = 7$
$n = 7 \div 2800$
$n = 0.0025$
$n = 0.25\%$

Objective B Exercises

27. **Strategy** To find what percent of couples disagree about financial matters, write and solve the basic percent equation using n to represent the unknown percent. The base is 10 and the amount is 7.

Solution $n \times 10 = 7$
$n = 7 \div 10$
$n = 0.70$
70% of couples disagree about financial matters.

29. **Strategy** To find what percent of the vegetables was wasted, write and solve the basic percent equation using n to represent the unknown percent. The base is 63 billion and the amount is 16 billion.

Solution $n \times 63 \text{ billion} = 16 \text{ billion}$
$n = 16 \text{ billion} \div 63 \text{ billion}$
$n \approx 0.254$
Approximately 25.4% of the

vegetables were wasted.

31. Strategy To find the percent of Americans with diabetes that have not been diagnosed:

- Find the total number of Americans with diabetes by adding the number that have been diagnosed (18.8 million) to the number that have not been diagnosed (7.0 million).
- Write and solve the basic percent equation using n to represent the percent of Americans with diabetes that have not been diagnosed. The base is the total number of Americans with diabetes and the amount is 7.0 million.

Solution

$$18.8 + 7.0 = 25.8$$

$$n \times 25.8 = 7.0$$

$$n = 7.0 \div 25.8$$

$$n \approx 0.2713$$

Approximately 27.1% of Americans with diabetes have not been diagnosed.

33. Strategy To find what percent of the slabs did meet safety requirements:

• Find how many slabs did meet safety requirements by subtracting the number that did not pass (3) from the total (200).

• Find the percent by writing and solving the basic percent equation using n to represent the unknown percent. The number that did pass (200 – 3 = 197) is the amount and the total (200) is the base.

Solution

$$\begin{array}{ll} 200 & n \times 200 = 197 \\ \underline{-\ 3} & n = 197 \div 200 \\ 197 & n = 0.985 = 98.5\% \end{array}$$

The percent of the slabs that did meet safety requirements was 98.5%.

Critical Thinking

35.

$$\begin{array}{r} 1,400 \\ 1,200 \\ 4,000 \\ 3,900 \\ 3,000 \\ +\ 1,100 \\ \hline 14,600 \end{array}$$

$14,600 is the total amount spent.

$3900 is spent on veterinary care.

$$\frac{3,900}{14,600} \approx 0.267$$

Approximately 26.7% of the total was spent on veterinary care.

37. The sum of the percents in the percent column is 113%. In order for the responses to be possible, the sum of the percents must be 100%.

Projects or Group Activities

39a. $\$25 - \$20 = \$5$ per share

b.

$$n \times 25 = 5$$

$$n = 5 \div 25$$

$$n = 0.20 = 20\%$$

c. $n \times 20 = 5$
$n = 5 \div 20$
$n = 0.25 = 25\%$

d. No

Section 5.4

Concept Check

1. Greater than

3. Less than

Objective A Exercises

5. $0.12 \times n = 9$
$n = 9 \div 0.12$
$n = 75$

7. $0.16 \times n = 8$
$n = 8 \div 0.16$
$n = 50$

9. $0.10 \times n = 10$
$n = 10 \div 0.10$
$n = 100$

11. $0.30 \times n = 25.5$
$n = 25.5 \div 0.30$
$n = 85$

13. $0.025 \times n = 30$
$n = 30 \div 0.025$
$n = 1200$

15. $1.25 \times n = 24$
$n = 24 \div 1.25$
$n = 19.2$

17. $2.4 \times n = 18$
$n = 18 \div 2.4$
$n = 7.5$

19. $0.15 \times n = 4.8$
$n = 4.8 \div 0.15$
$n = 32$

21. $0.128 \times n = 25.6$
$n = 25.6 \div 0.128$
$n = 200$

23. $0.30 \times n = 2.7$
$n = 2.7 \div 0.30$
$n = 9$

25. $\frac{1}{6} \times n = 84$
$n = 84 \div \frac{1}{6}$
$n = 504$

Objective B Exercises

27. **Strategy** To find the number of travelers who allowed their children to miss school, write and solve the basic percent equation using n to represent the number of travelers. The percent is 11% and the amount is 1.738 million.

Solution $11\% \times n = 1.738$
$0.11 \times n = 1.738$
$n = 1.738 \div 0.11$
$n = 15.8$

There were 15.8 million travelers who allowed their children to miss school to go along on a trip.

29. Strategy To find the number of runners that started the Boston Marathon in 2011, write and solve the basic percent equation using n to represent the number of runners that started the Boston Marathon in 2011. The percent is 98.2% and the amount is 23,913 people.

Solution
$$98.2\% \times n = 23{,}913$$
$$0.982 \times n = 23{,}913$$
$$n = 23{,}913 \div 0.982$$
$$n \approx 24{,}350$$

24,350 runners started the Boston Marathon in 2011.

31. Strategy To find the number of tons of fuel per day, write and solve the basic percent equation using n to represent the number of tons of fuel per day. The percent is 40% and the amount is 120 tons.

Solution
$$40\% \times n = 120$$
$$0.4 \times n = 120$$
$$n = 120 \div 0.4$$
$$n = 300$$

The large ship uses 300 tons of fuel per day.

33a. Strategy To find the number of computer boards tested, write and solve the basic percent equation using n to represent the number of computer boards tested. The percent is 0.8% and the amount is 24.

Solution
$$0.8\% \times n = 24$$
$$0.008 \times n = 24$$
$$n = 24 \div 0.008$$
$$n = 3000$$

3000 boards were tested.

b. Strategy To find the number of boards that were tested as not defective, subtract the number of defective boards (24) from the total tested (3000).

Solution
$$\begin{array}{r} 3000 \\ -\ \ 24 \\ \hline 2976 \end{array}$$

2976 boards were tested as not defective.

Projects or Group Activities

35a.
$$n \times 60 = 48$$
$$n = 48 \div 60$$
$$n = 0.80 = 80\%$$

b.
$$n \times 80 = 56$$
$$n = 56 \div 80$$
$$n = 0.70 = 70\%$$

c. $\dfrac{80 + 70}{2} = 75;\ 75\%$

d.
$$n \times (60 + 80) = 48 + 56$$
$$n \times 140 = 104$$
$$n = 104 \div 140$$
$$n \approx 0.74 = 74\%$$

No, the percent is not the same.

e. When both tests have the same number of points

Section 5.5

Concept Check

1. $\dfrac{\text{percent}}{100} = \dfrac{\text{amount}}{\text{base}}$

3. Percent

Objective A Exercises

5. $\dfrac{26}{100} = \dfrac{n}{250}$

$26 \times 250 = n \times 100$

$6500 = n \times 100$

$6500 \div 100 = n$

$65 = n$

7. $\dfrac{n}{100} = \dfrac{37}{148}$

$148 \times n = 37 \times 100$

$148 \times n = 3700$

$n = 3700 \div 148$

$n = 25$

37 is 25% of 148.

9. $\dfrac{68}{100} = \dfrac{51}{n}$

$68 \times n = 100 \times 51$

$68 \times n = 5100$

$n = 5100 \div 68$

$n = 75$

11. $\dfrac{n}{100} = \dfrac{43}{344}$

$n \times 344 = 100 \times 43$

$n \times 344 = 4300$

$n = 4300 \div 344$

$n = 12.5$

12.5% of 344 is 43.

13. $\dfrac{20.5}{100} = \dfrac{82}{n}$

$n \times 20.5 = 82 \times 100$

$n \times 20.5 = 8200$

$n = 8200 \div 20.5$

$n = 400$

15. $\dfrac{6.5}{100} = \dfrac{n}{300}$

$300 \times 6.5 = n \times 100$

$1950 = n \times 100$

$1950 \div 100 = n$

$19.5 = n$

17. $\dfrac{n}{100} = \dfrac{7.4}{50}$

$50 \times n = 7.4 \times 100$

$50 \times n = 740$

$n = 740 \div 50$

$n = 14.8$

7.4 is 14.8% of 50.

19. $\dfrac{50.5}{100} = \dfrac{n}{124}$

$50.5 \times 124 = n \times 100$

$6262 = n \times 100$

$6262 \div 100 = n$

$62.62 = n$

21. $\dfrac{220}{100} = \dfrac{33}{n}$

$n \times 220 = 33 \times 100$

$n \times 220 = 3300$

$n = 3300 \div 220$

$n = 15$

23a. (ii) and (iii)

b. (i) and (iv)

Objective B Exercises

25. **Strategy** To find the length of time the drug will be effective as determined by the testing

service, write and solve a proportion using n to represent the length of time determined by the testing service. The percent is 80% and the base is 6 hours.

Solution

$$\frac{80}{100} = \frac{n}{6}$$
$$100 \times n = 80 \times 6$$
$$100 \times n = 480$$
$$n = 480 \div 100$$
$$n = 4.8$$

The length of time that the drug will be effective, as determined by the testing service, is 4.8 hours.

27a. Strategy To find the cash generated annually from sales of Thin Mints, write and solve a proportion using n to represent the sales of Thin Mints. The percent is 25% and the base is \$700 million.

Solution

$$\frac{25}{100} = \frac{n}{700}$$
$$25 \times 700 = 100 \times n$$
$$17{,}500 = 100 \times n$$
$$17{,}500 \div 100 = n$$
$$175 = n$$

The sale of Thin Mints generates \$175 million.

b. Strategy To find the cash generated annually from sales of Trefoils, write and solve a proportion using n to represent the sales of Trefoils. The percent is 9% and the base is \$700 million.

Solution

$$\frac{9}{100} = \frac{n}{700}$$
$$9 \times 700 = 100 \times n$$
$$6300 = 100 \times n$$
$$6300 \div 100 = n$$
$$63 = n$$

The sale of Trefoils generates \$63 million.

29. Strategy To find the percent that have some college experience but have not earned a college degree, write and solve a proportion using n to represent the percent of baby boomers living in the United States that have some college experience but have not earned a college degree. The base is 78 million and the amount is 45 million.

Solution

$$\frac{n}{100} = \frac{45}{78}$$
$$n \times 78 = 100 \times 45$$
$$n \times 78 = 4500$$
$$n = 4500 \div 78$$
$$n \approx 57.7$$

57.7% of baby boomers living in the United States have some college experience but have not earned a college degree

31. Strategy To find the total turkey production, write and solve a proportion using n to represent the total turkey production. The percent is 13.5% and the amount is 963,000,000 pounds.

Solution

$$\frac{13.5}{100} = \frac{963,000,000}{n}$$
$$13.5 \times n = 963,000,000 \times 100$$
$$13.5 \times n = 96,300,000,000$$
$$n = 96,300,000,000 \div 13.5$$
$$n \approx 7,133,333,333$$

The total turkey production was 7 billion pounds.

Critical Thinking

33. 110th Senate

$$\frac{49}{100} = \frac{n}{100}$$
$$n = 49\%$$

110th House of Representatives

$$\frac{202}{435} = \frac{n}{100}$$
$$n \approx 46.4\% \text{ Republicans}$$

The 110th Senate had the larger percent of Republicans.

Projects or Group Activities

35. Gold: $75\% \times 6 = 0.75 \times 6 = 4.5$ grams
Copper: $20\% \times 6 = 0.20 \times 6 = 1.2$ grams
Silver: $5\% \times 6 = 0.05 \times 6 = 0.3$ gram

Chapter 5 Review Exercises

1. $0.30 \times 200 = n$
$60 = n$

2. $n \times 80 = 16$
$n = 16 \div 80$
$n = 0.2$
$n = 20\%$

3. $1\frac{3}{4} \times 100\% = 1.75 \times 100\% = 175\%$

4. $0.20 \times n = 15$
$n = 15 \div 0.20$
$n = 75$

5. $12\% = 12 \times \frac{1}{100} = \frac{12}{100} = \frac{3}{25}$

6. $0.22 \times 88 = n$
$19.36 = n$

7. $n \times 20 = 30$
$n = 30 \div 20$
$n = 1.5$
$n = 150\%$

8. $\frac{1}{6} \times n = 84$
$n = 84 \div \frac{1}{6}$
$n = 84 \times 6$
$n = 504$

9. $42\% = 42 \times 0.01 = 0.42$

10. $0.075 \times 72 = n$
$5.4 = n$

11. $\frac{2}{3} \times n = 105$
$n = 105 \div \frac{2}{3}$
$n = 105 \times \frac{3}{2}$
$n = 157.5$

12. $7.6\% = 7.6 \times 0.01 = 0.076$

13. $1.25 \times 62 = n$
$77.5 = n$

14. $16\frac{2}{3}\% = 16\frac{2}{3} \times \frac{1}{100} = \frac{50}{3} \times \frac{1}{100} = \frac{50}{300} = \frac{1}{6}$

15. $\frac{n}{100} = \frac{40}{25}$
$n \times 25 = 40 \times 100$
$n \times 25 = 4000 \div 25$
$n = 160$
160% of 25 is 40.

16. $\frac{20}{100} = \frac{15}{n}$
$20 \times n = 100 \times 15$
$20 \times n = 1,500$
$n = 1,500 \div 20$
$n = 75$

17. $0.38 \times 100\% = 38\%$

18. $0.78 \times n = 8.5$

$n = 8.5 \div 0.78$

$n \approx 10.89 \approx 10.9$

19. $n \times 30 = 2.2$

$n = 2.2 \div 30$

$n \approx 0.073$

$n \approx 7.3\%$

20. $n \times 15 = 2.2$

$n = 92 \div 15$

$n \approx 6.133$

$n \approx 613.3\%$

21. **Strategy** To find the percent of the questions answered correctly:

• Find the number of questions answered correctly by subtracting the number missed (9) from the total number of questions (60).

• Write and solve a proportion using n to represent the percent. The base is 60 and the amount is the number of questions answered correctly.

Solution $60 - 9 = 51$

$$\frac{n}{100} = \frac{51}{60}$$

$n \times 60 = 51 \times 100$

$n \times 60 = 5100$

$n = 5100 \div 60$

$n = 85$

The student answered 85% of the questions correctly.

22. **Strategy** To find how much of the budget was spent for newspaper advertising, write and solve the basic percent equation using n to represent the newspaper advertising. The percent is 7.5% and the base is \$60,000.

Solution $7.5\% \times \$60,000 = n$

$0.075 \times 60,000 = n$

$4500 = n$

The company spent \$4500 for newspaper advertising.

23. **Strategy** To find what percent of total energy use is electricity:

• Find the total of the costs given on the graph. This sum is the base.

• Write and solve the basic percent equation using n as the unknown percent. The cost for electricity is the amount.

Solution

$$\begin{array}{rl} & 1413 \text{ Electricity} \\ & 2132 \text{ Motor gasoline} \\ & 440 \text{ Natural gas} \\ + & 140 \text{ Fuel oil, kerosene} \\ \hline & 4125 \end{array}$$

$n \times 4125 = 1413$

$n = 1413 \div 4125$

$n \approx 0.343$

34.3% of the cost for electricity.

24. **Strategy** To find the total cost of the camcorder:

• Find the amount of the sales tax by writing and solving the basic percent equation using n to represent the sales tax. The percent is 6.25% and the base is \$980.

• Add the sales tax to the cost of the camcorder ($980).

Solution

$$6.25\% \times 980 = n \qquad 980.00$$
$$0.0625 \times 980 = n \quad + \quad 61.25$$
$$61.25 = n \qquad 1041.25$$

The total cost of the camcorder is $1041.25.

25. Strategy To find the percent of women who wore sunscreen often, write and solve the basic percent equation using n to represent the unknown percent. The base is 350 women and the amount is 275 women.

Solution

$$n \times 350 = 275$$
$$n = 275 \div 350$$
$$n \approx 0.7857$$

Approximately 78.6% of the women wore sunscreen often.

26. Strategy To find the world's population in 2000, write and solve the basic percent equation using n to represent the population in 2000. The percent is 155% and the amount is 9,400,000,000 people.

Solution

$$155\% \times n = 9,400,000,000$$
$$1.55 \times n = 9,400,000,000$$
$$n = 9,400,000,000 \div 1.$$
$$n \approx 6,100,000,000$$

The world's population in 2000 was approximately 6,100,000,000 people.

27. Strategy To find the cost of the computer 4 years ago, write and solve a proportion using n to represent the cost 4 years ago. The percent is 60% and the amount is $1800.

Solution

$$\frac{60}{100} = \frac{1800}{n}$$
$$60 \times n = 1800 \times 100$$
$$60 \times n = 180,000$$
$$n = 180,000 \div 60$$
$$n = 3000$$

The cost of the computer 4 years ago was $3000.

28. Strategy To find the total cranberry crop, write and solve a proportion using n to represent the total cranberry crop that year. The percent is 49.25% and the amount is 281.72 million pounds.

Solution

$$\frac{49.25}{100} = \frac{281.72}{n}$$
$$49.25 \times n = 100 \times 281.72$$
$$49.25 \times n = 28,172$$
$$n = 28,172 \div 49.25$$
$$n \approx 572$$

The total cranberry crop was 572 million pounds.

Chapter 5 Test

1. $97.3\% \times 97.3 \times 0.01 = 0.973$

2. $83\frac{1}{3}\% = 83\frac{1}{3} \times \frac{1}{100} = \frac{250}{3} \times \frac{1}{100} = \frac{250}{3006} = \frac{5}{6}$

3. $0.3 \times 100\% = 30\%$

4. $1.63 \times 100\% = 163\%$

5. $\frac{3}{2} \times 100\% = 1.5 \times 100\% = 150\%$

6. $\frac{37}{40} \times 100\% = \frac{3700}{40}\% = 92.5\%$

7. $77\% \times 65 = n$
$0.77 \times 65 = n$
$50.05 = n$

8. $47.2\% \times 130 = n$
$0.472 \times 130 = n$
$61.36 = n$

9. $\frac{11}{18} \times 100\% = \frac{1100}{18}\% = 61\frac{1}{9}\%$

10. $0.75\% = \frac{0.75}{100} = \frac{75}{10,000} = \frac{3}{400}$

11. $15\% \times n = 12$
$0.15 \times n = 12$
$n = 12 \div 0.15$
$n = 80$

12. $150\% \times n = 42.5$
$1.5 \times n = 42.5$
$n = 42.5 \div 1.5$
$n \approx 28.3$

13. $\frac{86}{100} = \frac{123}{n}$
$86 \times n = 123 \times 100$
$86 \times n = 12,300$
$n = 12,300 \div 86$
$n \approx 143.02$
$n \approx 143.0$

14. $\frac{n}{100} = \frac{120}{12}$
$12 \times n = 100 \times 120$
$12 \times n = 12,000$
$n = 12,000 \div 12$
$n = 1000$

1000% of 12 is 120.

15. **Strategy** To find the amount spent for advertising, write and solve the basic percent equation using n to represent the amount spent for advertising. The percent is 6% and the base is \$750,000.

Solution
$6\% \times 750,000 = n$
$0.06 \times 750,000 = n$
$45,000 = n$

The amount spent for advertising is \$45,000.

16. **Strategy** To find how many pounds of vegetables were not spoiled:
• Write and solve the basic percent equation using n to represent the number of pounds that were spoiled. The percent is 6.4% and the base is 1250.
• Find the number of pounds that were not spoiled by subtracting the number of pounds of spoiled vegetables from the total (1250 pounds).

Solution
$6.4\% \times 1250 = n$ 1250
$0.064 \times 1250 = n$ − 80
$80 = n$ 1170

1170 pounds of vegetables were not spoiled.

17. **Strategy** To find the percent, write and solve the basic percent equation using n to represent the percent of the daily recommended amount of potassium provided by one serving of cereal with skim milk. The amount is 440 milligrams and the base is 3000 milligrams.

Solution $n \times 3000 = 440$

$n = 440 \div 3000$

$n \approx 0.147$

14.7% of the daily recommended amount of potassium is provided.

18. Strategy To find the percent:

- Add the number of calories provided by a serving of cereal with skim milk (180 calories) to the additional number of calories provided using 2% milk (20 calories).
- Write and solve the basic percent equation using n to represent the percent of the daily recommended number of calories provided by one serving of this cereal with 2% milk. The base is the total number of calories recommended per day (2200 calories) and the amount is the total number of calories provided by the single serving of cereal with 2% milk.

Solution Total number of calories =

$180 + 20 = 200$

$n \times 2200 = 200$

$n = 200 \div 2200$

$n \approx 0.091$

9.1% of the daily recommended number of calories is provided.

19. Strategy To find what percent of the permanent employees is hired as temporary employees, write and solve the basic percent using n to represent the percent of the permanent employees. The base is 125 and the amount is 20.

Solution $n \times 125 = 20$

$n = 20 \div 125$

$n = 0.16$

$n = 16\%$

16% of the permanent employees are hired.

20. Strategy To find what percent of the questions the student answered correctly:

• Find how many questions the student answered correctly by subtracting the number missed (7) from the total number of questions (80).

• Write and solve the basic percent equation using n to represent the percent of questions answered correctly. The base is 80 and the amount is the number of questions answered correctly.

Solution $80 - 7 = 73$

$n \times 80 = 73$

$n = 73 \div 80$

$n = 0.9125$

$n \approx 91.3$

The student answered approximately 91.3% of the questions correctly.

21. Strategy To find the number of digital cameras tested, write and

solve the basic percent equation using n to represent the number of digital cameras tested. The percent is 1.2% and the amount is 384.

Solution

$$1.2\% \times n = 384$$
$$0.012 \times n = 384$$
$$n = 384 \div 0.012$$
$$n = 32{,}000$$

32,000 digital cameras were tested.

22. Strategy To find what percent the increase is of the original price:

• Find the amount of the increase by subtracting the original value ($285,000) from the price 5 years later ($456,000).

• Write and solve the basic percent equation using n to represent the percent. The base is the original price ($285,000) and the amount is the amount of the increase.

Solution

$$\begin{array}{r} 456{,}000 \\ -\ 285{,}000 \\ \hline 171{,}000 \end{array}$$

$$n \times 285{,}000 = 171{,}000$$
$$n = 171{,}000 \div 285{,}000$$
$$n = 0.60$$
$$n = 60\%$$

The increase is 60% of the original price.

23. Strategy To find the dollar increase in the hourly wage:

• Write and solve a proportion to find the hourly wage last year. Let n represent last year's wage. The amount is $16.24 and the percent is 112%.

• Subtract last year's wage from this year's wage ($16.24).

Solution

$$\frac{112}{100} = \frac{16.24}{n}$$
$$112 \times n = 16.24 \times 100$$
$$112 \times n = 1624$$
$$n = 1624 \div 112$$
$$n = 14.5$$

$$\begin{array}{r} 16.24 \\ -\ 14.50 \\ \hline 1.74 \end{array}$$

The dollar increase is $1.74.

24. Strategy To find what percent the population now is of the population 10 years ago, write and solve a proportion using n to represent the percent. The base is 32,500 and the amount is 71,500.

Solution

$$\frac{n}{100} = \frac{71{,}500}{32{,}500}$$
$$32{,}500 \times n = 71{,}500 \times 100$$
$$32{,}500 \times n = 7{,}150{,}000$$
$$n = \frac{7{,}150{,}000}{32{,}500}$$
$$n = 220$$

The population now is 220% of what it was 10 years ago.

25. Strategy To find the value of the car, write and solve a proportion using n to represent the value of the car. The percent is 1.4% and the amount is $350.

Solution

$$\frac{1.4}{100} = \frac{350}{n}$$
$$1.4 \times n = 350 \times 100$$
$$1.4 \times n = 35{,}000$$
$$n = 35{,}000 \div 1.4$$
$$n = 25{,}000$$

The value of the car is \$25,000.

Cumulative Review Exercises

1. $18 \div (7-4)^2 + 2 = 18 \div (3)^2 + 2$
$= 18 \div 9 + 2$
$= 2 + 2 = 4$

2.

	2	3	5
16 =	2·2·2·2		
24 =	2·2·2	3	
30 =	2	3	5

LCM = $2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 = 240$

3.
$$2\frac{1}{3} = 2\frac{8}{24}$$
$$3\frac{1}{2} = 3\frac{12}{24}$$
$$+4\frac{5}{8} = 4\frac{15}{24}$$
$$9\frac{35}{24} = 10\frac{11}{24}$$

4.
$$27\frac{5}{12} = 27\frac{20}{48} = 26\frac{68}{48}$$
$$-14\frac{9}{16} = 14\frac{27}{48} = 14\frac{27}{48}$$
$$12\frac{41}{48}$$

5.
$$7\frac{1}{3} \times 1\frac{5}{7} = \frac{22}{3} \times \frac{12}{7}$$
$$= \frac{22 \times 12}{3 \times 7}$$
$$= \frac{2 \cdot 11 \cdot 2 \cdot 2 \cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \cdot 7}$$
$$= \frac{88}{7} = 12\frac{4}{7}$$

6.
$$\frac{14}{27} \div 1\frac{7}{9} = \frac{14}{27} \div \frac{16}{9}$$
$$= \frac{14}{27} \times \frac{9}{16}$$
$$= \frac{14 \times 9}{27 \times 16}$$
$$= \frac{\overset{1}{\cancel{2}} \cdot 7 \cdot \overset{1}{\cancel{3}} \cdot \overset{1}{\cancel{3}}}{3 \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{2}} \cdot 2 \cdot 2 \cdot 2}$$
$$= \frac{7}{24}$$

7.
$$\left(\frac{3}{4}\right)^3\left(\frac{8}{9}\right)^2 + \frac{1}{9} = \left(\frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4}\right)\left(\frac{8}{9} \cdot \frac{8}{9}\right) + \frac{1}{9}$$
$$= \frac{27}{64} \cdot \frac{64}{81} + \frac{1}{9}$$
$$= \frac{1}{3} + \frac{1}{9}$$
$$= \frac{3}{9} + \frac{1}{9}$$
$$= \frac{4}{9}$$

8.
$$\left(\frac{2}{3}\right)^2 - \left(\frac{3}{8} - \frac{1}{3}\right) \div \frac{1}{2} = \frac{4}{9} - \left(\frac{9}{24} - \frac{8}{24}\right) \div \frac{1}{2}$$
$$= \frac{4}{9} - \frac{1}{24} \div \frac{1}{2}$$
$$= \frac{4}{9} - \left(\frac{1}{24} \times \frac{1}{2}\right)$$
$$= \frac{4}{9} - \frac{1}{12}$$
$$= \frac{16}{36} - \frac{3}{36} = \frac{13}{36}$$

9.
3.07973
Given place value
9 > 5
3.08

10.
$$\begin{array}{r} 2\ 10\ 8\ \overset{9}{1}0\ 12 \\ 3.0\,\cancel{9}\,\cancel{0}\,2 \\ -1.9706 \\ \hline 1.1196 \end{array}$$

11.

$$0.032\overline{)1.097.00000} \quad 34.28125 \approx 34.2813$$

$$\begin{array}{r} -96 \\ 137 \\ -128 \\ 90 \\ -64 \\ 260 \\ -256 \\ 40 \\ -32 \\ 80 \\ -64 \\ 160 \\ -160 \\ 0 \end{array}$$

12. $3\frac{5}{8} = \frac{29}{8}$

$$8\overline{)29.000} \quad 3.625$$

$$\begin{array}{r} -24 \\ 50 \\ -48 \\ 20 \\ -16 \\ 40 \\ -40 \\ 0 \end{array}$$

13. $1.75 = \frac{175}{100} = \frac{7}{4} = 1\frac{3}{4}$

14. $\frac{3}{8} = 0.375$

$\frac{3}{8} < 0.87$

15. $\frac{3}{8} = \frac{20}{n}$

$3 \times n = 8 \times 20$

$3 \times n = 160$

$n = 160 \div 3$

$n \approx 53.3$

16. $\frac{\$153.60}{8 \text{ hours}} = \$19.20/\text{hour}$

17. $18\frac{1}{3}\% = 18\frac{1}{3} \times \frac{1}{100} = \frac{55}{3} \times \frac{1}{100} = \frac{55}{300} = \frac{11}{60}$

18. $\frac{13}{18} \times 100\% = \frac{1300}{18}\% = 72\frac{2}{9}\%$

19. $16.3\% \times 120 = n$

$0.163 \times 120 = n$

$19.56 = n$

20. $n \times 18 = 24$

$n = 24 \div 18$

$n = 1.33....$

$n = 133\frac{1}{3}\%$

21. $125\% \times n = 12.4$

$1.25 \times n = 12.4$

$n = 12.4 \div 1.25$

$n = 9.92$

22. $n \times 35 = 120$

$n = 120 \div 35$

$n \approx 3.4285$

$n \approx 342.9\%$

23. **Strategy** To find Sergio's take-home pay:

- Find the amount deducted by multiplying the income ($740) by $\frac{1}{5}$.
- Subtract the amount deducted from the income.

Solution $\frac{1}{5} \times \$740 = \$148$

$\$740 - \$148 = \$592$

Sergio's take-home pay is $592.

24. **Strategy** To find the amount of the monthly payment:

- Find the amount that will be paid by payments by subtracting the down payment ($2000) from the

price of the car ($12,530).

• Divide the total amount remaining to be paid by the number of payments (36).

Solution

$$\begin{array}{r} 12{,}530 \\ -2000 \\ \hline 10{,}530 \end{array} \qquad \begin{array}{r} 292.50 \\ 36\overline{)10{,}530.00} \end{array}$$

Each monthly payment is $292.50.

25. Strategy To find the number of gallons of gasoline used during the month, divide the total paid in taxes ($172.20) by the tax paid per gallon ($.41).

Solution $172.20 \div 0.41 = 420$

420 gallons were used during the month.

26. Strategy To find the real estate tax on a house valued at $344,000, write and solve a proportion using n to represent the tax.

Solution

$$\frac{6880}{344{,}000} = \frac{n}{500{,}000}$$
$$6880 \times 500{,}000 = 344{,}000 \times n$$
$$3{,}440{,}000{,}000 = 344{,}000 \times n$$
$$3{,}440{,}000{,}000 \div 344{,}000 = n$$
$$10{,}000 = n$$

The real estate tax is $10,000.

27. Strategy To find the number of hotels, write and solve the basic percent equation using n to represent the number of hotels in the United States located along highways. The base is 51,015 and the percent is 14.4%.

Solution

$$14.4\% \times 51{,}015 = n$$
$$0.144 \times 51{,}015 = n$$
$$7346 \approx n$$

There are 7346 hotels in the United States located along highways.

28. Strategy To find what percent of the people did not favor the candidate:

• Find the number of people who did not favor the candidate by subtracting the number of people who did favor the candidate (165) from the total surveyed (300).

• Write and solve the basic percent equation using n to represent the percent of people who did not favor the candidate. The base is 300 and the amount is the number of people who did not favor the candidate.

Solution

$$\begin{array}{r} 300 \\ -165 \\ \hline 135 \end{array}$$

$n \times 300 = 135$

$n = 135 \div 300$

$n = 0.45$

$n = 45\%$

45% of the people did not favor the candidate

29. **Strategy** To find the average hours:

•Find the number of hours in a week by multiplying the number of hours in a day (24) by the number of days in a week (7).

• Write and solve the basic percent equation using n to represent the number of hours spent watching TV. The percent is 36.5% and the base is 168.

Solution

$$\begin{array}{r} 24 \\ \times\ 7 \\ \hline 168 \end{array} \qquad \begin{aligned} 36.5\% \times 168 &= n \\ 0.365 \times 168 &= n \\ 61.3 &\approx n \end{aligned}$$

The approximate average number of hours spent watching TV in a week is 61.3 hours.

30. **Strategy** To find what percent of the children tested had levels of lead that exceeded federal standards, write and solve a proportion using n to represent the percent who had levels of lead that exceeded federal standards. The base is 5500 and the amount is 990.

Solution

$$\frac{n}{100} = \frac{990}{5500}$$

$$\begin{aligned} n \times 5500 &= 990 \times 100 \\ n \times 5500 &= 99{,}000 \\ n &= 99{,}000 \div 5500 \\ n &= 18 \end{aligned}$$

18% of the children tested had levels of lead that exceeded federal standards.

Chapter 6: Applications for Business and Consumers

Prep Test

1. $3.75 \div 5 = 0.75$

2. $3.47 \times 15 = 52.05$

3. $874.50 - 369.99 = 504.51$

4. $0.065 \times 150{,}000 = 9750$

5. $1500 \times 0.06 \times 0.5 = 90 \times 0.5 = 45$

6. $1372.47 + 36.91 + 5.00 + 2.86 = 1417.24$

7.
$$3\overline{)10.000} \approx 3.33$$
$$\begin{array}{r} -9 \\ \hline 10 \\ -9 \\ \hline 10 \\ -9 \\ \hline 10 \\ -9 \\ \hline 1 \end{array}$$

8.
$$570\overline{)345.0000} \approx 0.605$$
$$\begin{array}{r} -3420 \\ \hline 300 \\ -\ 0 \\ \hline 3000 \\ -2850 \\ \hline 1500 \\ -1140 \\ \hline 360 \end{array}$$

9. $0.379 < 0.397$

Section 6.1

Concept Check

1. Unit cost is the cost of one item.

Objective A Exercises

3. **Strategy** To find the unit cost, divide the total cost ($.99) by the number of units (18).

Solution $0.99 \div 18 = 0.055$

The unit cost is $.055 per ounce.

5. **Strategy** To find the unit cost, divide the total cost ($2.99) by the number of units (8).

Solution $2.99 \div 8 \approx 0.3737$

The unit cost is $.374 per ounce.

7. **Strategy** To find the unit cost, divide the total cost ($3.99) by the number of units (50).

Solution $3.99 \div 50 = 0.0798$

The unit cost is $.080 per tablet.

9. **Strategy** To find the unit cost, divide the total cost ($13.95) by the number of units (2).

Solution $13.95 \div 2 = 6.975$

The unit price is $6.975 per clamp.

11. **Strategy** To find the unit cost, divide the total cost ($2.99) by the number of units (15).

Solution $2.99 \div 15 \approx 0.1993$

The unit cost is $.199 per ounce.

13. To find the unit cost, divide the price of one pint of ice cream by 2.

Objective B Exercises

15. **Strategy** To find the more economical purchase, compare the unit costs.

Solution Kraft: $3.98 \div 40 = 0.0995$
Springfield:
$3.39 \div 32 \approx 0.1059$
$0.0995 < 0.1059$
The Kraft mayonnaise is the more economical purchase.

17. Strategy To find the more economical purchase, compare the unit costs.

Solution L'Oréal shampoo:
$4.69 \div 13 \approx 0.3608$
Cortexx shampoo:
$3.99 \div 12 = 0.3325$
$0.3325 < 0.3608$
Cortexx shampoo is the more economical purchase.

19. Strategy To find the more economical purchase, compare the unit costs.

Solution Ultra Mr. Clean:
$2.67 \div 20 = 0.1335$
Ultra Spic and Span:
$2.19 \div 14 \approx 0.1564$
$0.1335 < 0.1564$
Ultra Mr. Clean is the more economical purchase.

21. Strategy To find the more economical purchase, compare the unit costs.

Solution Bertolli: $9.49 \div 34 \approx 0.2791$
Pompeian: $2.39 \div 8 \approx 0.2988$
$0.2791 < 0.2988$
Bertolli olive oil is the more economical purchase.

23. Strategy To find the more economical purchase, compare the unit costs.

Solution Wagner's:
$3.95 \div 1.5 \approx 2.6333$
Durkee: $2.84 \div 1 = 2.84$
$2.6333 < 2.84$
Wagner's vanilla extract is the more economical purchase.

25. Increase

Objective C Exercises

27. Strategy To find the total cost, multiply the unit cost ($.98) by the number of units (75).

Solution $0.98 \times 75 = 73.50$
The total cost is $73.50.

29. Strategy To find the total cost, multiply the unit cost ($4.69) by the number of units (3.6).

Solution $4.69 \times 3.6 = 16.884$
The total cost is $16.88.

31. Strategy To find the total cost, multiply the unit cost ($5.99) by the number of units (0.65).

Solution $5.99 \times 0.65 \approx 3.893$
The total cost is $3.89.

33. Strategy To find the total cost, multiply the unit cost ($9.49) by the number of units (2.8).

Solution $9.49 \times 2.8 = 26.572$
The total cost is $26.57.

Critical Thinking

35. A box of Tea A contains twice as many bags as a box of Tea B, so a box of Tea B contains half as many bags as a box of Tea A. If a box of Tea B cost half as much as a box of Tea A, then the price per tea bag would be equal. But,

because the price of a box of Tea B is greater than half the price of a box of Tea A, the price per tea bag for Tea B is greater than the price per bag for Tea A. A box of Tea A is the more economical purchase.

37. The Universal Product Code, or UPC, is a series of lines, bars, and numbers found on the packages of consumer products. The UPC is used with an optical scanning device that "reads" the UPC and signals the computer to search its memory for the price of the item.

Section 6.2

Concept Check

1. ii

3. Markup is an amount; markup rate is a percent.

Objective A Exercises

5. **Strategy** To find the percent increase:
• Find the amount of the increase by subtracting the amount spent last year ($5.8 billion) from the amount spent this year ($6.9 billion).
• Write and solve the basic percent equation for percent. The base is 5.8 and the amount is the amount of the increase.

Solution $6.9 - 5.8 = 1.1$

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 5.8 = 1.1$$
$$n = 1.1 \div 5.8$$
$$n \approx 0.190$$

The percent increase is 19.0%.

7. **Strategy** To find the percent increase:
• Subtract the number of members in the first year (7900) from the number of members in the second year (29,750).
• Write and solve the basic percent equation for percent. The base is 7900 and the amount is the amount of the increase.

Solution $29{,}750 - 7900 = 21{,}850$

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 7900 = 21{,}850$$
$$n = \frac{21{,}850}{7900}$$
$$n \approx 2.766$$

The percent increase is 276.6%.

9. **Strategy** To find the percent increase:
• Find the amount of the increase by subtracting the number of events in 1924 (14) from the number of events in 2014 (98).
• Write and solve the basic percent equation for percent. The base is 14 and the amount is the amount of the increase.

Solution $98 - 14 = 84$

Percent × base = amount

$n \times 14 = 84$

$n = 84 \div 14$

$n = 6$

The percent increase is 600%.

11. Strategy To find the percent increase:

• Find the amount of the increase by subtracting the amount Americans spent on pets a decade ago ($28.5 billion) from the amount spent ten years later ($50.84 billion).

• Write and solve the basic percent equation for percent. The base is 28.5 billion and the amount is the amount of the increase.

Solution $50.84 - 28.5 = 22.34$

Percent × base = amount

$n \times 28.5 = 22.34$

$n = 22.34 \div 28.5$

$n \approx 0.784$

The percent increase is 78.4%.

13. $\$12 \times 0.10 + \$12 = \$1.20 + \$12 = \$13.20$

$\$12\,(1.10) = \$13.20$

Yes

Objective B Exercises

15. (3) Markup rate × cost = markup

(2) Cost + markup = selling price

17. Strategy To find the markup, solve the basic percent equation for amount.

Solution Percent × base = amount

$38\% \times 45 = n$

$0.38 \times 45 = n$

$17.10 = n$

The markup is $17.10.

19. Strategy To find the markup rate, solve the basic percent equation for percent. The base is $20 and the amount is $12.

Solution Percent × base = amount

$n \times 20 = 12$

$n = 12 \div 20$

$n = 0.60 = 60\%$

The markup rate is 60%.

21. Strategy To find the selling price :

• Find the markup by solving the basic percent equation for amount.

• Add the markup to the cost.

Solution Percent × base = amount

$45\% \times 210 = n$

$0.45 \times 210 = n$

$94.50 = n$

The markup is $94.50.

$94.50 + 210 = 304.50$

The selling price is $304.50.

23. Strategy To find the selling price:

• Solve the basic percent equation for amount to find the amount of the markup.

• Add the amount of the markup to the cost ($50).

Solution Percent × base = amount

$48\% \times 50 = n$

$0.48 \times 50 = n$

$24 = n$

$50 + 24 = 74$

The selling price is \$74.

Objective C Exercises

25. **Strategy** To find the percent decrease, solve the basic percent equation for percent. The base is 45 and the amount is 18.

Solution Percent × base = amount

$n \times 45 = 18$

$n = 18 \div 45$

$n = 0.40 = 40\%$

The amount represents a decrease of 40%.

27. **Strategy** To find the percent decrease:

- Find the amount of the decrease by subtracting the number of incidents the second year (6604) from the number of incidents the second year (7783).
- Write and solve the basic percent equation for percent. The base is 7783 and the amount is the amount of the decrease.

Solution $7783 - 6604 = 1179$

Percent × base = amount

$n \times 7783 = 1179$

$n = 1179 \div 7783$

$n \approx 0.151 = 15.1\%$

The amount represents a decrease of 15.1%.

29. **Strategy** To find how much value the car loses, solve the basic percent equation for amount. The base is \$28,200 and the percent is 30%.

Solution Percent × base = amount

$30\% \times 28,200 = n$

$0.30 \times 28,200 = n$

$8460 = n$

The car loses \$8460 in value after 1 year.

31. **Strategy** To find the average monthly gasoline bill now:

- Find the amount of the decrease by solving the basic percent equation for amount. The base is \$176 and the percent is 20%.
- Subtract the amount of the decrease (\$35.20) from the original amount (\$76).

Solution Percent × base = amount

$20\% \times 176 = n$

$0.20 \times 176 = n$

$35.2 = n$

The amount of the decrease was \$35.20.

$176 - 35.20 = 140.80$

The average monthly gasoline bill now is \$140.80.

33. **Strategy** To find the percent decrease:

• Find the amount of the decrease by subtracting the earnings in 2008 (\$31.6 million) from the earnings in 2010 (\$25.4 million).

• Solve the basic percent equation for percent. The amount is the amount of the decrease and the base is 31.6.

Solution $31.6 - 25.4 = 6.2$

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 31.6 = 6.2$$
$$n = 6.2 \div 31.6$$
$$n \approx 0.196 = 19.6\%$$

The amount represents a decrease of 19.6%.

Objective D Exercises

35. (3) Discount rate ×regular price = discount

(2) Regular price – discount = sale price

37. **Strategy** To find the discount rate, solve the basic percent equation for percent. The base is \$24 and the amount is \$8.

Solution $\text{Percent} \times \text{base} = \text{amount}$

$$n \times 24 = 8$$
$$n = 8 \div 24$$
$$n = 0.333\ldots = 33\frac{1}{3}\%$$

The discount rate is $33\frac{1}{3}\%$.

39. **Strategy** To find the discount, solve the basic percent equation for amount. The percent is 20% and the base is \$400.

Solution $\text{Percent} \times \text{base} = \text{amount}$

$$20\% \times 400 = n$$
$$0.20 \times 400 = n$$
$$80 = n$$

The discount is \$80.

41. **Strategy** To find the discount rate, solve the basic percent equation for percent. The base is \$140 and the amount is \$42.

Solution $\text{Percent} \times \text{base} = \text{amount}$

$$n \times 140 = 42$$
$$n = 42 \div 140$$
$$n = 0.30 = 30\%$$

The discount rate is 30%.

43. **Strategy** To find the sale price:

- Find the discount by solving the basic percent equation for amount. The percent is 20% and the base is \$1.25.
- Subtract the discount (\$.25) from the original price (\$1.25).

Solution $\text{Percent} \times \text{base} = \text{amount}$

$$20\% \times 1.25 = n$$
$$0.20 \times 1.25 = n$$
$$0.25 = n$$

The discount is \$.25 per pound.

$1.25 - 0.25 = 1.00$

The sale price is \$1.00 per pound.

45. **Strategy** To find the discount rate:

- Find the amount of the discount by subtracting the sale price (\$16) from the regular price (\$20).
- Solve the basic percent equation for percent. The base is \$20 and the amount is the amount of the discount

Solution $20 - 16 = 4$

The discount is \$4.

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 20 = 4$$
$$n = 4 \div 20$$
$$n = 0.2 = 20\%$$

The discount rate is 20%.

Projects or Group Activities

47. 16 and older: $243 - 217 = 26$
$26 \div 217 \approx 0.120 = 12.0\%$

18 and older: $235 - 209 = 26$
$26 \div 209 \approx 0.124 = 12.4\%$

21 and older: $221 - 197 = 24$
$24 \div 197 \approx 0.122 = 12.2\%$

62 and older: $50 - 41 = 9$
$9 \div 41 \approx 0.220 = 22.0\%$

Ages 62 years and older has the greatest percent increase in population.

Section 6.3

Concept Check

1. Principal × annual interest rate × time (in years) = interest

3a. $10,000

b. $850

c. 4.25%

d. 2 years

Objective A Exercises

5. **Strategy** To find the simple interest, multiply the principal by the annual interest rate by the time (in years).

Solution $8000 \times 0.06 \times 2 = 960$

The simple interest owed is $960.

7. **Strategy** To find the simple interest, multiply the principal by the annual interest rate by the time (in years).

Solution $100{,}000 \times 0.045 \times \frac{9}{12} = 3375$

The simple interest due is $3375.

9. **Strategy** To find the simple interest, multiply the principal by the annual interest rate by the time (in years).

Solution $20{,}000 \times 0.088 \times \frac{9}{12} = 1320$

The simple interest due is $1320.

11. **Strategy** To find the simple interest, multiply the principal by the annual interest rate by the time (in years).

Solution $7500 \times 0.055 \times \frac{75}{365} \approx 84.76$

The simple interest due is $84.76

13. **Strategy** To find the maturity value of the loan, add the principal and the simple interest.

Solution $4800 + 320 = 5120$

The maturity value of the loan is $5120

15. **Strategy** To find the total amount due:

• Find the simple interest due by multiplying the principal by the annual interest rate by the time (in years).

• Find the total amount due by adding the principal and the simple interest.

Solution

$$12{,}500 \times 0.045 \times \frac{8}{12}$$

$$\approx 375$$

$$12{,}500 + 375 = 12{,}875$$

The total amount due on the loan is \$12,875.

17. Strategy To find the maturity value:

• Find the simple interest due by multiplying the principal by the annual interest rate by the time (in years).

• Find the maturity value by adding the principal and the simple interest.

Solution

$$14{,}000 \times 0.0525 \times \frac{270}{365}$$

$$\approx 543.70$$

$$14{,}000 + 543.70$$

$$= 14{,}543.70$$

The maturity value is \$14,543.70.

19. Strategy To find the monthly payment, divide the sum of the loan amount (\$225,000) and the interest (\$72,000) by the number of payments (48).

Solution

$$\frac{225{,}000 + 72{,}000}{48}$$

$$= 6187.50$$

The monthly payment is \$6187.50.

21a. Strategy To find the simple interest charged, multiply the principal (\$12,000) by the annual interest rate by the time (in years).

Solution

$$12{,}000 \times 0.045 \times 2$$

$$= 1080$$

The interest charged is \$1080.

b. Strategy To find the monthly payment, divide the sum of the loan amount (\$12,000) and the interest (\$1080) by the number of payments (24).

Solution

$$\frac{12{,}000 + 1080}{24} = 545$$

The monthly payment is \$545.

23. Strategy To find the monthly payment:

• Find the simple interest due by multiplying the principal by the annual interest rate by the time (in years).

• Find the monthly payment by adding the interest due to the loan amount (\$142,000) and dividing that sum by the number of payments (66).

Solution $142,000 \times 0.075 \times 5.5$
$= 58,575$

$$\frac{142,000 + 58,575}{66}$$
≈ 3039.02

The monthly payment is $3039.02

25a. Student A's principal is equal to Student B's principal; the students borrowed the same amount of money.

b. Student A's maturity value is greater than Student B's maturity value; Student A's loan has a longer term and accumulates interest for a longer period of time.

c. Student A's monthly payment is less than Student B's monthly payment; the payments are spread out over a longer period of time for Student A, so Student A does not need to pay as much per month to pay off the loan.

Objective B Exercises

27. Strategy To find the finance charge, multiply the unpaid balance by the monthly interest rate by the number of months.

Solution $391.64 \times 0.0175 \times 1 = 6.85$.

The finance charge is $6.85.

29. Strategy To find the finance charge, multiply the unpaid balance by the monthly interest rate by the number of months.

Solution $995.04 \times 0.012 \times 1 \approx 11.94$

The finance charge is $11.94.

31. Strategy To find the difference in finance charges:

• Find the difference in monthly interest rates by subtracting the smaller rate (1.25%) from the larger rate (1.75%).

• To find the difference in finance charges, multiply the unpaid balance by the difference in monthly interest rates by the number of months.

Solution $0.0175 - 0.0125 = 0.005$
$= 0.5\%$

$687.45 \times 0.005 \times 1 \approx 3.44$

The difference in finance charges is $3.44.

33. The finance charge the first month was exactly equal to the minimum monthly payment, so no money was applied to the principal amount borrowed. The second month, the principal is the same as the first month so the finance charge will again be $10, equal to the finance charge from the first month. No, you will not eventually pay off the balance with this payment plan.

Objective C Exercises

35. Strategy To find the value of the investment after 20 years, multiply the original investment by the compound interest factor.

Solution $2500 \times 2.85744 = 7143.6$

The value of the investment after 20 years is $7143.60.

37. Strategy To find the value of the investment after 5 years, multiply the original

investment by the compound interest factor.

Solution $20,000 \times 1.417625 = 28,352.50$

The value of the investment after 5 years is \$28,352.50.

39a. Strategy To find the value of the investment in 10 years, multiply the original investment by the compound interest factor.

Solution $3000 \times 2.01362 = 6040.86$

The value of the investment in 10 years will be \$6040.86.

b. Strategy To find how much interest will be earned, subtract the original investment from the new value of the investment.

Solution $6040.86 - 3000 = 3040.86$

The amount of interest earned in 10 years will be \$3040.86.

41. Strategy To find the amount of interest earned over a 2-year period:

• Find the value of the investment after 1 year by multiplying the original investment by the compound interest factor.

• Find the value of the investment after the second year by multiplying the new investment (4245.44) by the compound interest factor.

• Subtract the original value of the investment (\$4000) from the value of the investment after 2 years.

Solution $4000 \times 1.06136 = 4245.44$

$4245.44 \times 1.06136 \approx 4505.94$

$4505.94 - 4000 = 505.94$

The amount of interest earned is \$505.94.

Critical Thinking

43. You received less interest during the second month because there are fewer days in the month of September (30 days) than in the month of August (31 days).

Using the simple interest formula:

$$500 \times 0.05 \times \frac{31}{365} \approx 2.12$$

$$502.12 \times 0.05 \times \frac{30}{365} \approx 2.06$$

Even though the principal is greater during the second month, the interest earned is less because there are fewer days in the month.

Section 6.4

Objective A Exercises

1. Mortgage

Objective A Exercises

3. Strategy To find the mortgage, subtract the down payment from the purchase price.

Solution $197,000 - 24,550 = 172,450$

The mortgage is \$172,450.

5. Strategy To find the down payment, solve the basic percent equation for amount. The base is \$850,000 and the percent is 25%.

Solution Percent × base = amount
$0.25 \times 850{,}000 = 212{,}500$
The down payment is \$212,500.

7. Strategy To find the loan origination fee, solve the basic percent equation for amount. The base is \$150,000 and the percent is $2\frac{1}{2}\%$.

Solution Percent × base = amount
$0.025 \times 150{,}000 = 3750$
The loan origination fee is \$3750.

9a. Strategy To find the down payment, solve the basic percent equation for amount. The base is \$350,000 and the percent is 10%.

Solution Percent × base = amount
$0.10 \times 350{,}000 = 35{,}000$
The down payment is \$35,000.

b. Strategy To find the mortgage, subtract the down payment from the purchase price.

Solution $350{,}000 - 35{,}000 = 315{,}000$
The mortgage is \$315,000.

11. Strategy To find the mortgage:
• Find the down payment by solving the basic percent equation for amount. The percent is 10% and the base is \$210,000.
• Subtract the down payment from the purchase price.

Solution Percent × base = amount
$0.10 \times 210{,}000 = 21{,}000$
$210{,}000 - 21{,}000 = 189{,}000$
The mortgage is \$189,000.

13. (iii); find 10% of the purchase price and subtract this amount from the purchase price.

Objective B Exercises

15. Strategy To find the monthly mortgage payment, multiply the mortgage by the monthly mortgage factor.

Solution $90{,}000 \times 0.0071643 \approx 644.79$
The monthly mortgage payment is \$644.79.

17. Strategy To determine whether the lawyer can afford the monthly mortgage payment:
• Find the monthly mortgage payment by multiplying the mortgage by the monthly mortgage factor.
• Compare the monthly mortgage payment with \$3500.

Solution $525{,}000 \times 0.0079079 = 4151.65$
$\$4151.65 > \$4000$
No, the lawyer cannot afford the monthly mortgage payment.

19a. Strategy To find the mortgage:
• Find the down payment by solving the basic percent equation for *amount*.
Subtract the down payment from the purchase price.

Solution $0.20 \times 312{,}500 = 62{,}500$
$312{,}500 - 62{,}500 = 250{,}000$
The mortgage is \$250,000.

b. Strategy To find the monthly mortgage payment, multiply the mortgage by the factor in

the Monthly Payment Table for a 30-year loan at 4.75%.

Solution The factor from the Monthly Payment Table is 0.0052165.

$250{,}000 \times 0.0052165 = 1304.13$ The monthly mortgage payment is \$1304.13.

21. Strategy To find the mortgage payment:

- Find the down payment.
- Subtract the down payment from the purchase price to find the mortgage.

Multiply the mortgage by the factor in the Monthly Payment Table for a 30-year loan at 5.5%.

Solution $0.25 \times 299{,}000 = 74{,}750$

The down payment is \$74,750.

$299{,}000 - 74{,}750 = 224{,}250$

The mortgage is \$224,250.

The factor from the Monthly Payment Table is 0.0056779.

$224{,}250 \times 0.0056779 = 1273.27$

The monthly mortgage payment is \$1273.27.

23. Strategy To find the amount of the first month's payment that is interest and the amount that goes to paying off the principal:

- Find the monthly simple interest rate.
- Use the basic percent equation to find the interest owed for the first month.

Subtract the interest owed for the first month from the monthly payment to find the amount of the payment that goes to paying off the principal.

Solution $\frac{0.05}{12} \approx 0.0041667$

$0.0041667 \times 720{,}000 \approx 3000$

The interest owed for the first month is \$3000.

$3865.10 - 3000 = 865.10$

The amount paid toward the principal is \$865.10.

Critical Thinking

25. Choice 1: 8% for 20 years

100,000 × 0.0083644 = 836.44/month

Payback = 836.44 × 240 months = \$200,745.60, or 100,745.60 in interest

Choice 2: 8% for 30 years

100,000 × 0.0073376 = 733.76

Payback = 733.76 × 360 months = \$264,153.60 or 164,153.60 in interest

\$164,153.60 – 100,745.60 = \$63,408

By using the 20-year loan, the couple will save \$63,408.

Check Your Progress: Chapter 6

1. Strategy To find the unit cost, divide the cost of the package by the number of units in the package.

Solution $\frac{45.99}{12} \approx 3.83$

The unit cost is \$3.83.

2. Strategy To find the more economical purchase, compare the unit costs.

Solution $18.49 \div 20 = 0.9245$
$12.99 \div 16 = 0.81175$
$\$0.92 > \$0.81$
The more economical purchase is 16 ounces for $12.99.

3. Strategy To find the total cost, multiply the unit cost ($2.97) by the number of units (15).

Solution $2.97 \times 15 = 44.55$
The total cost of 15 square yards of bluegrass sod is $44.55.

4. Strategy To find the percent increase:
- Find the amount of the increase.
- Solve the basic percent equation for *percent*.

Solution 8 billion – 7 billion = 1 billion
$n \times 7 = 1$
$n = 1 \div 7$
$n \approx 0.143$
The percent increase is 14.3%.

5. Strategy To find the selling price:
- Find the markup by solving the basic percent equation for *amount*.
- Add the markup to the cost.

Solution $0.40 \times 225 = n$
$90 = n$
$225 + 90 = 315$
The selling price is $315.

6. Strategy To find the percent decrease:
- Find the amount of the decrease.
- Solve the basic percent equation for *percent.*

Solution $185 - 168 = 17$
$n \times 185 = 17$
$n = 17 \div 185$
$n \approx 0.092$
The percent decrease in the agent's weight is 9.2%.

7. Strategy To find the sale price:
- Find the discount by solving the basic percent equation for *amount*.
- Subtract to find the sale price.

Solution $0.20 \times 89.95 = n$
$17.99 = n$
$89.95 - 17.99 = 71.96$
The sale price is $71.96.

8. Strategy To find the simple interest due, multiply the principal (1500) times the annual interest rate (8% = 0.08) times the time in years (18 months = 1.5 years).

Solution $1500 \times 0.08 \times 1.5 = 180$
The borrowers will pay $180 in interest.

9. Strategy To find the finance charge, multiply the principal, or unpaid balance (365) times the monthly interest rate (1.8%) times the number of months (1).

Solution $365 \times 0.018 \times 1 = 6.57$
The finance charge is $6.57.

10. Strategy To find the value of the investment:
- Find the amount of interest earned by multiplying the original principal (2500) by the factor found in the Compound

Interest Table (1.69040).

- Add the interest earned to the principal.

Solution $2500 \times 1.69040 = 4226$

The value of the investment is $4226.

11. Strategy To find the mortgage:

- Find the down payment by solving the basic percent equation for *amount*.
- Subtract the down payment from the purchase price.

Solution $0.20 \times 236,000 = 47,200$

$236,000 - 47,200 = 188,800$

The mortgage is $188,800.

12. Strategy To find the monthly mortgage payment, multiply the mortgage (175,000) by the factor in the Monthly Payment Table for a 15-year loan at 5.5%.

Solution The factor from the Monthly Payment Table is 0.0081708.

$175,000 \times 0.0081708 = 1429.89$

The monthly mortgage payment is $1429.89.

Section 6.5

Concept Check

1. Use the basic percent equation to find 20% of the purchase price of the car.

Objective A Exercises

3. Strategy To determine whether Amanda has enough money for the down payment:

• Find the down payment by solving the basic percent equation for amount. The base is $7100 and the percent is 12%.

• Compare the required down payment with $780.

Solution Percent × base = amount

0.12×7100

= 852 down payment

$852 > $780

No, Amanda does not have enough for the down payment.

5. Strategy To find how much sales tax is paid, solve the basic percent equation for amount. The base is $26,500 and the percent is 4.5%.

Solution $0.045 \times 26,500 = 1192.5$

The sales tax is $1192.50

7. Strategy To find the state license fee, solve the basic percent equation for amount. The base is $32,500 and the percent is 2%.

Solution Percent × base = amount

$0.02 \times 32,500 = 650$

The license fee is $650.

9a. Strategy To find the sales tax, solve the basic percent equation for amount. The base is $32,000 and the percent is 3.5%.

Solution Percent × base = amount

$0.035 \times 32,000 = 1120$

The sales tax is $1120.

b. Strategy To find the total cost of the sales tax and license fee, add the sales tax ($1120) and the license fee ($275).

Solution $1120 + 275 = 1395$

The total cost of the sales tax and license fee is $1395.

11a. Strategy To find the down payment, solve the basic percent equation for amount. The base is $16,200 and the percent is 25%.

Solution Percent $\times$ base = amount

$0.25 \times 16{,}200 = 4050$

The down payment is $4050.

b. Strategy To find the amount financed, subtract the down payment from the purchase price.

Solution $16{,}200 - 4050 = 12{,}150$

The amount financed is $12,150.

13. Strategy To find the amount financed:

• Find the amount of the down payment by solving the basic percent equation for amount. The base is $45,000 and the percent is 20%.

• Subtract the down payment from the purchase price ($45,000).

Solution Percent $\times$ base = amount

$0.20 \times 45{,}000 = 9000$

$45{,}000 - 9000 = 36{,}000$

The amount financed is $36,000.

15. The expression represents the total cost of buying the car.

Objective B Exercises

17. To find the cost to drive 23,000 miles, multiply the number of miles by the cost per mile.

19. Strategy To find the monthly car payment, multiply the amount financed by the monthly payment factor.

Solution $18{,}000 \times 0.0307629 \approx 553.73$

The monthly car payment is $553.73.

21. Strategy To find the cost per mile:

- Find the total cost of the expenses over the 5-year period.
- Divide the total cost by the number of miles driven (75,000).

Solution

$$\begin{array}{r} 2\,573 \\ 3\,650 \\ 14{,}764 \\ 11{,}457 \\ +\ 5\,686 \\ \hline 38{,}129 \end{array}$$

$38{,}129 \div 75{,}000 \approx 0.51$

The cost is $.51 per mile.

23. Strategy To find the monthly payment:

- Find the down payment by solving the basic percent equation for *amount*.
- Subtract the down payment from the purchase price to find the amount financed.
- Multiply the amount financed by the factor found in the Monthly Payment Table.

Solution $0.20 \times 36,995 = n$

$7399 = n$

The down payment is \$7399.

$36995 - 7399 = 29,596$

The amount financed is \$29,596.

$29,596 \times 0.0228035 = 674.89$

The monthly payment is \$674.89.

25. Strategy To find the cost per mile for gasoline, divide the total cost by the number of miles.

Solution $2685 \div 15,000 = 0.179$

The cost was \$.18 per mile.

Projects or Group Activities

27. After 1 year, the car is worth

$30,000 - 0.17(30,000) = \$24,900.$

After 2 years, the car is worth

$24,900 - 0.12(24,900) = \$21,912.$

After 3 years, the car is worth

$21,912 - 0.10(21,912) = \$19,720.80.$

After 4 years, the car is worth

$19,720.80 - 0.10(19,720.80) = \$17,748.72.$

After 5 years, the car is worth

$17,748.72 - 0.10(17,748.72) = \$15,973.85.$

The car has depreciated by

$30,000 - 15,973.85 = \$14,026.15.$

The cost per mile for depreciation is

$14,026.15 \div 75,000 \approx \$.187$ per mile.

Section 6.6

Concept Check

1. Commissions are calculated as a percent of sales.

Objective A Exercises

3. Strategy To find the earnings, multiply the hourly wage by the number of hours.

Solution $11.50 \times 40 = 460$

Lewis earns \$460.

5. Strategy To find the commission, solve the basic percent equation for amount. The base is \$131,000 and the percent is 3%.

Solution Percent × base = amount

$0.03 \times 131,000 = 3930$

The real estate agent's commission is \$3930.

7. Strategy To find the commission, solve the basic percent equation for amount. The base is \$5600 and the percent is 1.5%.

Solution Percent × base = amount

$0.015 \times 5600 = 84$

The stockbroker's commission is \$84.

9. Strategy To find the monthly salary, divide the annual salary by 12.

Solution $38,928 \div 12 = 3244$

Keisha receives \$3244 a month.

11. Strategy To find the commission, solve the basic percent equation for amount. The base is \$4500 and the percent is 12%.

Solution Percent × base = amount

$0.12 \times 4500 = 540$

Carlos's commission was \$540.

13. **Strategy** To find the earnings, multiply the earnings per square yard by the number of square yards.

Solution $5.75 \times 160 = 920$

Steven receives $920.

15. **Strategy** To find the chemist's hourly wage, divide the total wage by the number of hours.

Solution $15,000 \div 120 = 125$

125 The chemist's hourly wage is $125.

17a. **Strategy** To find the hourly wage for overtime, multiply the regular wage by 2 (double time).

Solution $10.78 \times 2 = 21.56$

Gil's overtime hourly wage is $21.56.

b. **Strategy** To find the earnings, multiply the overtime hourly wage by the number of hours.

Solution $21.56 \times 16 = 344.96$

Gil earns $344.96 for overtime.

19a. **Strategy** To find the increase in pay for the evening shift, solve the basic percent equation for amount. The base is $12.68 and the percent is 15%.

Solution Percent × base = amount

$0.15 \times 12.68 \approx 1.90$

The increase in pay is $1.90.

b. **Strategy** To find the hourly wage for the evening shift, add the increase in pay to the regular hourly wage

Solution $12.68 + 1.90 = 14.58$

The clerk's hourly wage for the evening shift is $14.58.

21. **Strategy** To find the earnings for the week:

• Find the amount of sales over $1500 by subtracting $1500 from the total sales ($4826).

• Find the commission by solving the basic percent equation for amount. The base is the sales over $1500 and the percent is 15%.

• Add the commission to the weekly salary ($250).

Solution $4826 - 1500 = 3326$

Percent × base = amount

0.15×3326

$= 498.90$ commission

$250 + 498.90 = 748.90$

The salesperson's earnings were $748.90.

Critical Thinking

23. $23.01 \times 34.3 \approx \$789.24$

25. $23.09 - 23.01 = 0.08$

$n \times 23.01 = 0.08$

$n = 0.08 \div 23.01$

$n \approx 0.003$

The percent increase was 0.3%.

Section 6.7

Concept Check

1. The payee is the person or business to whom the check is written.

Objective A Exercises

3. **Strategy** To find your current checking balance, add the deposit to the old balance.

Solution 342.51 + 143.81 = 486.32

Your current checking account balance is $486.32.

5. **Strategy** To find the current checking account balance, subtract the amount of each check from the original balance.

Solution

$$\begin{array}{r} 1204.63 \\ -\ 119.27 \\ \hline 1085.36 \\ -\ 260.09 \\ \hline 825.27 \end{array}$$

The nutritionist's current balance is $825.27.

7. **Strategy** To find the current checking account balance, add the amount of the deposit to the old balance. Then subtract the amount of each check.

Solution

$$\begin{array}{r} 3476.85 \\ +\ 1048.53 \\ \hline 4525.38 \\ -\ 848.37 \\ \hline 3677.01 \\ -\ 676.19 \\ \hline 3000.82 \end{array}$$

The current checking account balance is $3000.82.

9. **Strategy** To determine whether there is enough money in the account, compare $675 with the current balance after finding the current checking account balance.

Solution

$$\begin{array}{r} 404.96 \\ +\ 350.00 \\ \hline 754.96 \\ -\ 71.29 \\ \hline 683.67 \end{array}$$

$683.67 > $675

Yes, there is enough money in the carpenter's account to purchase the refrigerator.

11. **Strategy** To determine whether there is enough money in the account to make the two purchases, add the amounts of the two purchases and compare the total with the current checking account balance.

Solution 3500 + 2050
= 5550 purchases
$5550 < $5625.42

Yes, there is enough money in the account to make the two purchases.

13. The ending balance might be less than the starting balance because the check written might be for an amount that is greater than the sum of the two deposits.

Objective B Exercises

15. **Solution**

Current balance:	989.86
Checks: 228	419.32
233	166.40
235	+288.39
	1863.97
Interest:	+13.22
	1877.19
Service charge:	–0.00
	1877.19
Deposits:	–0.00
Checkbook balance:	1877.19

Current bank balance from bank statement: $1877.19.
Checkbook balance: $1877.19.
The bank statement and checkbook balance.

17. **Solution**

Current balance:	1051.92
Checks: 223	414.83
224	113.37
Interest:	+5.15
	1585.27
Service charge:	– 0.00
	1585.27
Deposits:	–0.00
Checkbook balance:	1585.27

Current bank balance from bank statement: $1585.27.
Checkbook balance: $1585.27.
The bank statement and checkbook balance.

Critical Thinking

19. When applied to a checking account, a credit is a deposit into the account. A debit is a payment or withdrawal from the account.

Chapter 6 Review Exercises

1. **Strategy** To find the unit cost, divide the total cost ($3.90) by the number of units (20).

Solution $3.90 \div 20 = 0.195$
The unit cost is $.195 per ounce or 19.5¢ per ounce.

2. **Strategy** To find the cost per mile:
- Find the total cost by adding the amounts spent ($1025.58, $1805.82, $37.92, and $288.27).
- Divide the total cost by the number of miles (11,320).

Solution $1025.58 + 1805.82 + 37.92 + 288.27 = 3157.59$
$3157.59 \div 11{,}320 \approx 0.279$
The cost is $.279 or 27.9¢ per mile.

3. **Strategy** To find the percent increase:
- Find the amount of the increase by subtracting the original price ($42.375) from the increased price ($55.25).
- Solve the basic percent equation for percent. The base is $42.375 and the amount is the amount of the increase.

Solution

$$55.25 - 42.375 = 12.875$$
$$n \times 42.375 = 12.875$$
$$n = \frac{12.875}{42.375}$$
$$\approx 0.304$$
$$= 30.4\%$$

The percent increase is 30.4%.

4. **Strategy** To find the markup, solve the basic percent equation for amount. The base is \$180 and the percent is 40%.

Solution

$$0.40 \times 180 = n$$
$$72 = n$$

The markup is \$72.

5. **Strategy** To find the simple interest, multiply the principal by the annual interest rate by the time (in years).

Solution

$$100{,}000 \times 0.04 \times \frac{9}{12}$$
$$= 3000$$

The simple interest due is \$3000.

6. **Strategy** To find the value of the investment in 10 years, multiply the original investment by the compound interest factor.

Solution $25{,}000 \times 1.82203 = 45{,}550.75$

The value of the investment after 10 years is \$45,550.75.

7. **Strategy** To find the percent increase:

• Find the amount of the increase by subtracting the original amount (\$4.12) from the increased amount (\$4.73).

• Solve the basic percent equation for percent. The base is \$4.12 and the amount is the increased amount.

Solution

$$4.73 - 4.12 = 0.61$$
$$n \times 4.12 = 0.61$$
$$n = 0.61 \div 4.12$$
$$n \approx 0.15$$
$$n = 15\%$$

The percent increase is 15%.

8. **Strategy** To find the amount of the first month's payment that is interest and the amount that goes to paying off the principal:

• Find the monthly simple interest rate.

• Use the basic percent equation to find the interest owed for the first month.

• Subtract the interest owed for the first month from the monthly payment to find the amount of the payment that goes to paying off the principal.

Solution

$$\frac{0.04}{12} \approx 0.00333333$$
$$0.00333333 \times 350{,}000$$
$$= 1166.67$$

The interest owed for the

first month is $1166.67.

2120.93 – 1166.67 = 954.26

The amount paid toward the principal is $954.26.

9. **Strategy** To find the monthly payment:

• Find the down payment by solving the basic percent equation for amount. The percent is 8% and the base is $24,450.

• Find the amount financed by subtracting the down payment from the purchase price ($24,450).

• Multiply the amount financed by the monthly payment factor.

Solution $0.08 \times 24{,}450 = 1956$

$24{,}450 - 1956 = 22{,}494$

$22{,}494 \times 0.0230293$

≈ 518.02

The monthly payment is $518.02.

10. **Strategy** To find the value of the investment in 1 year, multiply the original investment by the compound interest factor.

Solution $50{,}000 \times 1.07186 = 53{,}593$

The value of the investment will be $53,593.

11. **Strategy** To find the down payment, solve the basic percent equation for amount. The base is $195,000 and the percent is 15%.

Solution $0.15 \times 195{,}000 = 29{,}250$

The down payment is $29,250.

12. **Strategy** To find the total cost of the sales tax and license fee:

• Find the sales tax by solving the basic percent equation for amount. The base is $28,500 and the percent is 6.25%.

• Add the sales tax and the license fee ($315).

Solution $0.0625 \times 28{,}500 = 1781.25$

$1781.25 + 315 = 2096.25$

The total cost of the sales tax and license fee is $2096.25.

13. **Strategy** To find the selling price:

• Find the markup by solving the basic percent equation for amount. The percent is 35% and the base is $1540.

• Find the selling price by adding the markup to the cost.

Solution $0.35 \times 1540 = 539$

$539 + 1540 = 2079$

The selling price is $2079.

14. **Strategy** To find how much of the payment is interest, subtract the principal

($65.45) from the total payment ($222.78).

Solution $222.78 - 65.45 = 157.33$

The interest paid is $157.33.

15. Strategy To find the commission, solve the basic percent equation for amount. The base is $108,000 and the percent is 3%.

Solution $0.03 \times 108{,}000 = n$

$3240 = n$

The commission was $3240.

16. Strategy To find the sale price:

- Find the amount of the discount by solving the basic percent equation for amount. The base is $235 and the percent is 40%.
- Subtract the discount from the original price.

Solution $0.40 \times 235 = n$

$94 = n$

$235 - 94 = 141$

The discount price is $141.

17. Strategy To find the current checkbook balance, subtract the amount of each check and add the amount of the deposit.

Solution

$$\begin{array}{r} 1568.45 \\ -123.76 \\ \hline 1444.69 \\ -756.45 \\ \hline 688.24 \\ -88.77 \\ \hline 599.47 \\ +344.21 \\ \hline 943.68 \end{array}$$

The current checkbook balance is $943.68.

18. Strategy To find the maturity value:

- Find the simple interest due by multiplying the principal by the annual interest rate by the time (in years).
- Find the maturity value by adding the principal and the simple interest.

Solution $30{,}000 \times 0.08 \times \frac{6}{12}$

$= 1200$

$30{,}000 + 1200$

$= 31{,}200$

The maturity value is $31,200.

19. Strategy To find the origination fee, solve the basic percent equation for amount. The base is $75,000 and the percent is $2\frac{1}{2}\%$.

Solution $0.025 \times 75{,}000 = 1875$

The origination fee is $1875.

20. Strategy To find the more economical purchase, compare the unit costs.

Solution

$3.49 \div 16 \approx 0.218$

$6.99 \div 33 \approx 0.212$

The more economical purchase is 33 ounces for $6.99.

21. Strategy To find the monthly mortgage payment:

- Find the down payment by solving the basic percent equation for amount. The base is $356,000 and the percent is 10%.
- Find the amount financed by subtracting the down payment from the purchase price.
- Find the monthly mortgage payment by multiplying the amount financed by the monthly mortgage factor.

Solution

$0.10 \times 356{,}000 = 35{,}600$

$356{,}000 - 35{,}600 = 320{,}40$

$320{,}400 \times 0.006653 = 2131.$

The monthly mortgage payment is $2131.62.

22. Strategy To find the total income:

- Find the overtime wage by multiplying the regular wage by 1.5 (time and half).
- Find the number of overtime hours worked by subtracting the regular weekly schedule (40) from the total hours worked (48).
- Find the wages earned for overtime by multiplying the overtime wage by the number of overtime hours worked.
- Find the wages for the 40-hour week by multiplying the hourly rate ($12.60) by 40.
- Add the pay from the overtime hours to the pay from the regular week.

Solution

$1.5 \times 12.60 = 18.90$

$48 - 40 = 8;\ 8 \times 18.90 = 15$

$40 \times 12.60 = 504$

$504 + 151.20 = 655.20$

The total income was $655.20.

23. Strategy To find the donut shop's current checkbook balance, subtract the amount of each check and add the amount of each deposit.

Solution

$$\begin{array}{r} 9567.44 \\ -\ 1023.55 \\ \hline 8543.89 \\ -\ 345.44 \\ \hline 8198.45 \\ -\ 23.67 \\ \hline 8174.78 \\ +\ 555.89 \\ \hline 8730.67 \\ +\ 135.91 \\ \hline 8866.58 \end{array}$$

The donut shop's checkbook balance is $8866.58.

24. **Strategy** To find the monthly payment, divide the sum of the loan amount ($55,000) and the interest ($1375) by the number of payments (4).

Solution $\frac{55{,}000 + 1375}{4} = 14{,}093.75$

The monthly payment is $14,093.75.

25. **Strategy** To find the finance charge, multiply the unpaid balance by the monthly interest rate by the number of months.

Solution $576 \times 0.0125 \times 1 = 7.2$

The finance charge is $7.20.

Chapter 6 Test

1. **Strategy** To find the cost per foot, divide the total cost ($138.40) by the number of feet (20).

Solution $138.40 \div 20 = 6.92$

The cost per foot is $6.92.

2. **Strategy** To find the more economical purchase, compare the unit prices of the items.

Solution $7.49 \div 3$ or $12.59 \div 5$

$7.49 \div 3 \approx 2.50$

$12.59 \div 5 \approx 2.52$

The more economical purchase is 3 pounds for $7.49.

3. **Strategy** To find the total cost, multiply the cost per pound ($4.15) by the number of pounds (3.5).

Solution $4.15 \times 3.5 \approx 14.53$

The total cost is $14.53.

4. **Strategy** To find the percent increase:

- Find the amount of the increase by subtracting the original price ($415) from the increased price ($498).
- Solve the basic percent equation for percent. The base is $415 and the amount is the amount of the increase.

Solution $498 - 415 = 83$

$n \times 415 = 83$

$n = 83 \div 415$

$n = 0.20 = 20\%$

The percent increase in the cost of the exercise bicycle is 20%.

5. **Strategy** To find the selling price:

- Find the amount of the markup by solving the basic percent equation for amount. The percent is 40% and the base is $315.
- Add the markup to the cost ($315).

Solution $0.40 \times 315 = 126$

$315 + 126 = 441$

The selling price of a blu-ray disc player is $441.

6. **Strategy** To find the percent increase:

• Find the amount of the increase by subtracting the original value ($1498) from the increased value ($1684).

• Solve the basic percent equation for percent. The base is ($1498) and the amount is the amount of the increase.

Solution

$$1684 - 1498 = 186$$
$$n \times 1498 = 186$$
$$n = 186 \div 1498$$
$$n \approx 0.124 = 12.4\%$$

The percent decrease is 12.4%.

7. **Strategy** To find the percent decrease:

• Find the amount of the decrease by subtracting the decreased value ($896) from the original value ($1120).

• Solve the basic percent equation for percent. The base is $1120 and the amount is the amount of the decrease.

Solution

$$1120 - 896 = 224$$
$$n \times 1120 = 224$$
$$n = 224 \div 1120$$
$$n = 0.20$$
$$n = 20\%$$

The percent decrease is 20%.

8. **Strategy** To find the sale price:

• Find the amount of the discount by solving the basic percent equation for amount. The base is $299 and the percent is 30%.

• Subtract the amount of the discount from the regular price ($299).

Solution

$$0.30 \times 299 = n$$
$$897 = n$$
$$299 - 89.70 = 209.30$$

The sale price of the corner hutch is $209.30.

9. **Strategy** To find the discount rate:

• Find the amount of the discount by subtracting the sale price ($5.70) from the regular price ($9.50).

• Solve the basic percent equation for percent. The base is $9.50 and the amount is the amount of the discount.

Solution

$$9.50 - 5.70 = 3.80$$
$$n \times 9.50 = 3.80$$
$$n = 3.80 \div 9.50$$
$$n = 0.40$$
$$n = 40\%$$

The discount rate is 40%.

10. **Strategy** To find the simple interest due, multiply the principal by the annual interest rate by the time in years.

Solution

$$75{,}000 \times 0.08 \times \frac{4}{12} = 2000$$

The simple interest due is $2000.

11. **Strategy** To find the maturity value:

• Find the simple interest due by multiplying the principal by the annual interest rate by the time (in years).

• Find the maturity value by

adding the principal and the simple interest.

Solution

$$25{,}000 \times 0.092 \times \frac{9}{12} = 1725$$
$$25{,}000 + 1725 = 26{,}725$$

The maturity value is $26,725.

12. Strategy To find the finance charge, multiply the unpaid balance by the monthly interest rate by the number of months.

Solution $374.95 \times 0.012 \times 1 = 4.50$

The finance charge is $4.50.

13. Strategy To find the interest earned:

- Find the value of the investment in 10 years by multiplying the original investment by the compound interest factor.
- Find the interest earned by subtracting the original investment from the new value of the investment.

Solution

$$30{,}000 \times 1.81402$$
$$= 54{,}420.6$$
$$54{,}420.60 - 30{,}000$$
$$= 24{,}420.60$$

The amount of interest earned in 10 years will be $24,420.60.

14. Strategy To find the loan origination fee, solve the basic percent equation for amount. The base is $134,000 and the percent is $2\frac{1}{2}\%$.

Solution $0.025 \times 134{,}000 = 3350$

The origination fee is $3350.

15. Strategy To find the monthly mortgage payment, multiply the mortgage amount by the monthly mortgage factor.

Solution $222{,}000 \times 0.0077182 \approx 1713.44$

The monthly mortgage payment is $1713.44.

16. Strategy To find the amount financed:

- Find the amount of the down payment by solving the basic percent equation for amount. The base is $23,750 and the percent is 20%.
- Subtract the down payment from the purchase price.

Solution

$$0.20 \times 23{,}750 = 4{,}750$$
$$23{,}750 - 4{,}750 = 19{,}000$$

The amount financed is $19,000.

17. Strategy To find the monthly car payment:

- Find the amount of the down payment by solving the basic percent equation for amount. The base is $33,714 and the percent is 15%.
- Find the amount financed by subtracting the down payment from the purchase price ($33,714).
- Multiply the amount financed by the monthly mortgage factor.

Solution

$0.15 \times 33{,}714 = 5{,}057.10$

$33{,}714 - 5{,}057.10$

$= 28{,}656.90$

$28{,}656.90 \times 0.0239462$

≈ 686.224

The monthly car payment is \$686.22.

18. Strategy To find Shaney's total weekly earnings:

- Find the hourly overtime wage for multiplying the hourly wage (\$30.40) by 1.5 (time and a half).
- Find the earnings for overtime by multiplying the number of overtime hours (15) by the hourly overtime wage.
- Find the earnings for the normal hours worked by multiplying the number of hours worked (30) by the hourly rate (\$30.40).
- Add the earnings from the night hours to the salary from the normal hours.

Solution

$30.40 \times 1.5 = 45.60$

$15 \times 45.60 = 684$

$30 \times 30.40 = 912$

$684 + 912 = 1596$

Shaney earns \$1596.

19. Strategy Find the current checkbook balance by subtracting the checks written and adding the deposit to the original balance.

Solution

$$\begin{array}{r} 7349.44 \\ -1349.67 \\ \hline 5999.77 \\ -\ 344.12 \\ \hline 5655.65 \\ +\ 956.60 \\ \hline 6612.25 \end{array}$$

The current checkbook balance is \$6612.25.

20. Solution

Current balance:	1106.31
Checks:	322.37
	413.45
	+78.20
	1920.33
Service charge:	–0.00
	1920.33
Deposits:	–0.00
Checkbook balance:	1920.33

Current bank balance from bank statement: \$1920.33.

Checkbook balance: \$1920.33.

The bank statement and checkbook balance.

Cumulative Review Exercises

1. $12 - (10-8)^2 \div 2+3$

$12 - 2^2 \div 2 + 3$

$12 - 4 \div 2 + 3$

$12 - 2 + 3$

$10 + 3 = 13$

2.

$$\begin{array}{r} 3\frac{1}{3} = 3\frac{8}{24} \\ 4\frac{1}{8} = 4\frac{3}{24} \\ +1\frac{1}{12} = 1\frac{2}{24} \\ \hline 8\frac{13}{24} \end{array}$$

3. $12\frac{3}{16} = 12\frac{9}{48} = 11\frac{57}{48}$

$$\begin{array}{r} -9\frac{5}{12} = 9\frac{20}{48} = 9\frac{20}{48} \\ \hline 2\frac{37}{48} \end{array}$$

4. $5\frac{5}{8}\times 1\frac{9}{15} = \frac{45}{8}\times\frac{24}{15}$

$$= \frac{45\times 24}{8\times 15}$$

$$= \frac{\overset{1}{3}\cdot 3\cdot \overset{1}{5}\cdot \overset{1}{2}\cdot \overset{1}{2}\cdot \overset{1}{2}\cdot 3}{\underset{1}{2}\cdot \underset{1}{2}\cdot \underset{1}{2}\cdot \underset{1}{3}\cdot \underset{1}{5}} = 9$$

5. $3\frac{1}{2}\div 1\frac{3}{4} = \frac{7}{2}\div\frac{7}{4} = \frac{7}{2}\times\frac{4}{7} = \frac{\overset{1}{7}\cdot \overset{1}{2}\cdot 2}{\underset{1}{2}\cdot \underset{1}{7}} = 2$

6. $\left(\frac{3}{4}\right)^2 \div \frac{3}{8} - \frac{1}{4} + \frac{1}{2}$

$$= \frac{3}{4}\cdot\frac{3}{4} \div \frac{3}{8} - \frac{2}{8} + \frac{1}{2}$$

$$= \frac{9}{16}\div\frac{1}{8} + \frac{1}{2}$$

$$= \frac{9}{16}\times\frac{8}{1} + \frac{1}{2}$$

$$= \frac{9}{2} + \frac{1}{2} = \frac{10}{2} = 5$$

7.

$$\begin{array}{r} 52.18 \approx 52.2 \\ 0.059\overset{\curvearrowright}{.}\overset{\curvearrowright}{)}3.079.20 \\ \underline{-295} \\ 129 \\ \underline{-118} \\ 112 \\ \underline{-59} \\ 530 \\ \underline{-472} \\ 58 \end{array}$$

8. $\frac{17}{12} = 17\div 12$

$$\begin{array}{r} 1.4166 \\ 12\overline{)17.0000} \\ \underline{-12} \\ 50 \\ \underline{-48} \\ 20 \\ \underline{-12} \\ 80 \\ \underline{-72} \\ 80 \\ \underline{-72} \\ 8 \end{array}$$

$\frac{17}{12} \approx 1.41\overline{6}$

9. $\frac{\$410}{8 \text{ hours}} = \$51.25/\text{hour}$

10. $\frac{5}{n} = \frac{16}{35}$

$$5\times 35 = n\times 16$$

$$175 = n\times 16$$

$$175\div 16 = n$$

$$10.9375 = n$$

$$10.94 \approx n$$

11. $\frac{5}{8}\times 100\% = \frac{500}{8}\% = 62.5\%$

12. 6.5% of 420 = 0.065 × 420 = 27.3

13. 18.2 × 0.01 = 0.182

14. $n\times 20 = 8.4$

$$n = 8.4\div 20 = 0.42 = 42\%$$

15. $0.12\times n = 30$

$$n = 30\div 0.12 = 250$$

16. $0.42\times n = 65$

$$n = 65\div 0.42 \approx 154.76$$

17. **Strategy** To find the total rainfall for the 3 weeks, add the 3 weekly amounts

$3\frac{3}{4}$, $8\frac{1}{2}$, and $1\frac{2}{3}$ inches.

Solution

$$\begin{aligned} 3\frac{3}{4} &= 3\frac{9}{12} \\ 8\frac{1}{2} &= 8\frac{6}{12} \\ +1\frac{2}{3} &= 1\frac{8}{12} \\ \hline 12\frac{23}{12} &= 13\frac{11}{12} \end{aligned}$$

The total rainfall is $13\frac{11}{12}$ inches.

18. **Strategy** Find the amount paid in taxes by multiplying the total monthly income ($4850) by the portion paid in taxes $\frac{1}{5}$.

Solution $4850 \times \frac{1}{5} = 970$

The amount paid in taxes is $970.

19. **Strategy** To find the ratio:

• Find the amount of the decrease by subtracting the decreased price ($30) from the original price ($75).

• Write in simplest form the ratio of the decrease to the original price.

Solution $75 - 30 = 45$

$\frac{45}{75} = \frac{3}{5}$

The ratio is $\frac{3}{5}$.

20. **Strategy** To find the number of miles driven per gallon of gasoline, divide the number of miles driven (417.5) by the number of gallons used (12.5).

Solution $417.5 \div 12.5 = 33.4$

The mileage was 33.4 miles per gallon.

21. **Strategy** To find the unit cost, divide the total cost ($15.40) by the number of pounds (14).

Solution $15.40 \div 14 \approx 1.1$

The cost is $1.10 per pound.

22. **Strategy** To find the dividend on 200 shares, write and solve a proportion.

Solution

$$\frac{80}{112} = \frac{200}{n}$$

$$80 \times n = 112 \times 200$$

$$80 \times n = 22{,}400$$

$$n = 22{,}400 \div 80$$

$$n = 280$$

The dividend is $280.

23. **Strategy** To find the sale price:

• Solve the basic percent equation for amount to find the amount of the discount. The base is $900 and the percent is 20%.

• Subtract the discount from the regular price.

Solution $0.20 \times 900 = 180$

$900 - 180 = 720$

The sale price is $720.

24. **Strategy** To find the selling price:

• Find the amount of markup by solving the basic percent equation for amount. The base

is \$85 and the percent is 40%.

• Add the markup to the cost.

Solution $0.40 \times 85 = 34$

$85 + 34 = 119$

The selling price of the grinding rail is \$119.

25. Strategy To find the percent increase:

• Find the amount of the increase by subtracting the original value from the value after the increase.

• Solve the basic percent equation for the percent. The base is \$2800 and the amount is the amount of the increase.

Solution $3024 - 2800 = 224$

$n \times 2800 = 224$

$n = 224 \div 2800$

$n = 0.08$

$n = 8\%$

The percent increase in Sook Kim's salary is 8%.

26. Strategy To find the simple interest due, multiply the principal by the annual rate by the time (in years).

Solution $120{,}000 \times 0.045 \times \frac{6}{12} = 2700$

The simple interest due is \$2700.

27. Strategy To find the monthly payment:

• Find the amount financed by subtracting the down payment from the purchase price.

• Multiply the amount financed by the monthly mortgage factor.

Solution $26{,}900 - 2{,}000 = 24{,}900$

$24{,}900 \times 0.0317997 \approx 791.812$

The monthly car payment is \$791.81.

28. Strategy To find the new checking account balance, add the deposit to the original balance and subtract the check amounts.

Solution

$$\begin{array}{r} 1846.78 \\ +568.30 \\ \hline 2415.08 \\ -123.98 \\ \hline 2291.10 \\ -47.33 \\ \hline 2243.77 \end{array}$$

The family's new checking account balance is \$2243.77.

29. Strategy To find the cost per mile:

• Find the total cost by adding the expenses (\$1840, \$520, \$185, and \$432).

• Divide the total cost by the number of miles driven (10,000).

Solution

$$\begin{array}{r} 1840 \\ 820 \\ 185 \\ +432 \\ \hline 3277 \end{array}$$

$3277 \div 10{,}000 = 0.3277$

The cost per mile is about \$.33.

30. Strategy To find the monthly mortgage payment, multiply the mortgage amount by the monthly mortgage factor.

Solution $172{,}000 \times 0.0071643 \approx 1232.26$

The monthly mortgage payment is $1232.26.

Chapter 7: Statistics and Probability

Prep Test

1. **Strategy** To find the percent of the emails that were spam, solve the basic percent equation for *amount.*

Solution $0.891 \times (107 \text{ trillion}) = n$

$95 \text{ trillion} \approx n$

95 trillion emails were spam.

2. **Strategy** To find the percent increase:

- Find the amount of the increase by subtracting the median annual income for a worker with a high school degree ($34,197) from the median annual income for a worker with a Bachelor's degree ($57,026).
- Write and solve the basic percent equation for *percent*.

Solution

$$57{,}026 - 34{,}197 = 22{,}829$$

$$n \times 34{,}197 = 22{,}829$$

$$n = \frac{22{,}829}{34{,}197}$$

$$n \approx 0.668$$

$$= 66.8\%$$

The percent increase is 66.8%.

3. $\dfrac{11 \text{ gold}}{7 \text{ silver}} = \dfrac{11}{7}$

4. $16\% = 16 \times \dfrac{1}{100} = \dfrac{16}{100} = \dfrac{4}{25}$

$\dfrac{4}{25}$ of women in the military are in the Navy.

Section 7.1

Concept Check

1. $4.5 \times 10 = 45$ chocolate chip cookies

Objective A Exercises

3. **Strategy** To find the gross revenue:

- Read the pictograph to determine the gross revenue of the four movies.
- Add the four numbers.

Solution

$$\begin{array}{r} 250 \text{ million} \\ 350 \text{ million} \\ 700 \text{ million} \\ +\ 300 \text{ million} \\ \hline 1650 \text{ million} = 1.65 \text{ billion} \end{array}$$

The gross revenue is $1.65 billion.

5. **Strategy** To find the percent, solve the basic percent equation for percent. The base is 1.65 billion (from Exercise 3) and the amount is the revenue from *Avatar* (750 million).

Solution Percent × base = amount

$n \times 1.65 \text{ billion} = 750 \text{ million}$

$n = 750 \div 1650$

$n \approx 0.45$

The percent is 45%.

7. **Strategy** To find how many more people agreed that humanity should explore planets than agreed that space exploration impacts daily life, subtract the number that agreed that space

exploration impacts daily life (600) from the number that agreed that humanity should explore planets (650).

Solution $650 - 600 = 50$

50 more people agreed that humanity should explore space than agreed that space exploration impacts daily life.

9. Strategy To find the number of children who said they hid vegetables under a napkin, write and solve the basic percent equation for amount. The percent is 30% and the base is 500.

Solution Percent × base = amount

$0.30 \times 500 = 150$

150 children said they hid their vegetables under a napkin.

11. No, the sum of the percents given in the graph is only 80%, not 100%.

13. Sample answers: Bill Gates's net worth is three times Alice Walton's net worth. George Kaiser's net worth is one-half Alice Walton's net worth.

Objective B Exercises

15. Strategy To determine whether the number of units required in humanities is less than or greater than twice the number of units required in science:

- Multiply the number of units required in science (8) by 2.
- Compare this result to the number of units required in humanities (15).

Solution $8 \times 2 = 16$

$15 < 16$

The number of units required in humanities is less than twice the number of units required in science

17a. People talking was the complaint mentioned the most often.

b. Uncomfortable seats was the complaint mentioned the least often.

19. Strategy To find the ratio:

• Read the circle graph to determine the number of people responding "dirty floors" and "high ticket prices."

• Write in simplest form the ratio of the number of people responding "dirty floors" to the number of people responding "high ticket prices."

Solution Dirty floors: 27 people

High ticket prices: 33 people

$$\frac{27}{33} = \frac{9}{11}$$

The ratio is $\frac{9}{11}$.

21. Strategy To find the amount of money spent:

• Read the circle graph to find the percent of money spent on video game hardware in 2010.

• Use the basic percent equation to find the amount.

Solution 35% was spent on video game hardware in 2010.

$$\text{Percent} \times \text{base} = \text{amount}$$
$$0.34 \times 18{,}600{,}000{,}000 = n$$
$$6{,}324{,}000{,}000 = n$$

Americans spent $6,324,000,000 on video game hardware in 2010.

23. Strategy To find the fractional amount spent on accessories:

• Use the basic percent equation to find the amount spent on accessories.

• Write the ratio of the amount spent on accessories to the total amount spent in simplest form.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$
$$0.16 \times 18{,}600{,}000{,}000 = 2{,}976{,}000{,}000$$
$$\frac{2{,}976{,}000{,}000}{18{,}600{,}000{,}000} = \frac{4}{25}$$

The fractional amount is $\frac{4}{25}$.

25. The age group 31 to 50 represents the largest segment.

27. Strategy To find the percent of the sheltered homeless population under 30, add the percent of homeless under 18 (22.2%) and the percent of homeless aged 18 to 30 (22.3%).

Solution 22.2% + 22.3% = 44.5%

The percent of the sheltered homeless population under age 30 is 44.5%.

29. Strategy To find the total land area of the seven continents:

• Read the circle graph to determine the land area of the seven continents.

• Add the seven numbers.

Solution

2,970,000	Australia
4,060,000	Europe
5,100,000	Antarctica
6,870,000	South America
9,420,000	North America
11,670,000	Africa
+ 17,150,000	Asia
57,240,000	

The total land area is 57,240,000 square miles.

31. Strategy To find the percent:

• Read the circle graph to determine the land area of Asia.

• Write and solve the basic percent equation for percent. The amount is the land area of Asia and the base is the total land area of the seven continents. (57,240,000 square miles).

Solution The area of Asia is 17,150,000 square miles.

Percent × base = amount

$n \times 57{,}240{,}000 = 17{,}150{,}000$

$n = 17{,}150{,}000 \div 57{,}240{,}000$

$n \approx 0.300$

Asia is 30.0% of the total land area.

33. Strategy To find the number of people living in the United States that are of Asian racial origin:

• Locate the percent of the population that is Asian.

• Solve the basic percent equation for amount.

Solution Percent that is Asian: 4.8%

Percent × base = amount

$0.048 \times 300{,}000{,}000 = 14{,}400{,}000$

14,400,000 people are of Asian racial origin.

35. Strategy To find the average number of people of black racial origin would be in a random sample of 500,000 people living in the United States:

- Locate the percent of the population that is of black racial origin.
- Solve the basic percent equation.

Solution Percent that is of black racial origin: 12.6%

Percent × base = amount

$0.126 \times 500{,}000 = 63{,}000$

There would be an average of 63,000 people of black racial origin.

Critical Thinking

37. Answers will vary. For example: The couple's largest single expense was rent.

Food represents approximately one-quarter of the month's expenditures.

Rent represents approximately one-third of the month's expenditures.

The expenditure for food is approximately the same as the expenditures for entertainment and transportation.

The couple spent more for transportation than for entertainment.

Projects or Group Activities

39.

$$1\frac{3}{4}(500{,}000) - 1\frac{1}{4}(500{,}000) = \frac{1}{2}(500{,}000)$$

$$= 250{,}000 \text{ cars}$$

Section 7.2

Objective A Exercises

1. The data value associated with that bar

Objective A Exercises

3. Strategy To find the length of the longest zipline, read the bar graph to determine which bar is the tallest.

Solution The longest zipline is 6600 feet long.

5. **Strategy** To find the difference in lengths:

- Read the bar graph to determine the lengths of the Pronutro and Kapohokine ziplines.
- Subtract to find the difference.

Solution Pronutro zipline: 6600 feet
Kapohokine zipline: 3400 feet
6600 – 3400 = 3200
The difference in the lengths is 3200 feet.

7. **Strategy** To determine in which year the world population was approximately 6 billion people, read the bar graph to locate the bar representing this value.

Solution The world population was approximately 6 billion people in 2000.

9. **Strategy** To estimate the difference between the maximum salaries in New York:

- Read the double-bar graph for the maximum salaries for city and suburb police officers.
- Subtract to find the difference between the two salaries.

Solution

$$\begin{array}{rr} \text{Suburb salary:} & 60{,}000 \\ \text{City salary:} & -\ 44{,}000 \\ \hline & 16{,}000 \end{array}$$

The maximum salary of police officers in the suburbs is $16,000 higher than the maximum salary of police officers in the city.

11. **Strategy** To find which city has the greatest difference between the maximum salary in the city and in the suburb:

- Read the double-bar graph to find maximum salaries for in the city and the suburb.
- Subtract the maximum salary in the city from the maximum salary in the suburb.

Solution Washington, D.C.:
51,000 – 41,000 = 10,000
Detroit:
46,000 – 38,000 = 8,000
New York:
60,000 – 44,000 = 16,000
Philadelphia:
56,000 – 38,000 = 18,000
Los Angeles:
52,000 – 49,000 = 3,000
The greatest difference in salaries is in Philadelphia.

13. (iii)

Objective B Exercises

15. **Strategy** To find the amount of snowfall during January, read the broken-line graph for January.

Solution The amount of snowfall during January was 20 inches.

17. **Strategy** To find the total snowfall during March and April:

• Read the broken-line graph to find the snowfall amounts for March and April.

• Add the two amounts.

Solution

$$\begin{array}{r} \text{March} \quad 17 \\ \text{April} \quad +\,8 \\ \hline 25 \end{array}$$

The snowfall during March and April was 25 inches.

19. Strategy To find the amount of wind power capacity for 2018, read the broken-line graph for 2018.

Solution The amount of wind power capacity produced in 2018 is estimated to be 100 gigawatts.

21. Strategy To find the difference:

- Read the broken-line graph to find the estimated capacity for 2014 and for 2022.
- Subtract to find the difference.

Solution 2014: 50 gigawatts

2022: 160 gigawatts

160 – 50 = 110

The difference is 110 gigawatts.

23. Strategy To find what age and gender has the lowest number of recommended Calories, read the double broken-line graph and select the age and gender beneath the lowest point.

Solution The age and gender that has the lowest number of recommended Calories is for women age 75+.

25. True

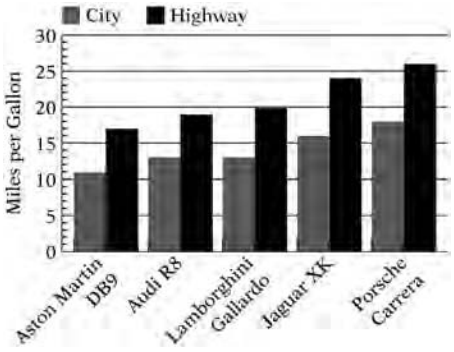
Critical Thinking

27.

Year	Wind Power Capacity in Iowa (megawatts)	Wind Power Capacity in California (megawatts)
2000	200	1600
2001	300	1700
2002	400	1800
2003	500	2000
2004	600	2100
2005	800	2200
2006	900	2400
2007	1300	2400
2008	2800	2500
2009	3600	2800
2010	3700	3300

Projects or Group Activities

29.



Section 7.3

Concept Check

1. A range of data values

Objective A Exercises

3. **Strategy** Read the histogram to find the number of account balances between \$1500 and \$2000.

Solution 13 account balances were between \$1500 and \$2000.

5. **Strategy** To find the percent:

• Read the histogram to find the number of account balances between \$2000 and \$2500.

• Solve the basic percent equation for percent. The base is 50 and the amount is the number of account balances between \$2000 and \$2500.

Solution Number of account balances between \$2000 and \$2500: 11

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 50 = 11$$
$$n = 11 \div 50$$
$$n = 0.22$$

The percent is 22%.

7. **Strategy** To find the number of cars between 6 and 12 years old:

• Read the histogram to find the number of cars between 6 and 9 years old and the number between 9 and 12 years old.

• Add the two numbers.

Solution

6 to 9 years:	220 cars
9 to 12 years:	+ 190 cars
	410 cars

There are 410 cars between 6 and 12 years old.

9. **Strategy** To find the number of cars more than 12 years old:

• Read the histogram to find the number of cars 12 to 15 years old and the number 15 to 18 years old.

• Add the two numbers.

Solution

12 to 15 years:	90 cars
15 to 18 years:	+ 140 cars
	230 cars

230 cars are more than 12 years old.

11. **Strategy** To find the consecutive class intervals with the greatest difference in class frequency:

- Find the difference in the class frequency between consecutive intervals.
- Compare the results.

Solution Number of cars between 0 and 3 years old: 170

Number of cars between 3 and 6 years old: 190

Difference: 20

Number of cars between 3 and 6 years old: 190

Number of cars between 6 and 9 years old: 220

Difference: 30

Number of cars between 6 and 9 years old: 220

Number of cars between 9

and 12 years old: 190
Difference: 30
Number of cars between 9 and 12 years old: 190
Number of cars between 12 and 15 years old: 90
Difference: 100
Number of cars between 12 and 15 years old: 90
Number of cars between 15 and 18 years old: 140
Difference: 50
The greatest difference is between the class intervals 9-12 and 12-15.

13. Strategy To find the number of adults who spend between 3 and 4 hours at the mall per trip, read the histogram.

Solution 18 adults spend between 3 and 4 hours at the mall per trip.

Objective B Exercises

15. Strategy To find the number of runners, find the sum of all the runners who had finishing times between 2 1/2 hours and 6 hours.

Solution

$$\begin{array}{r} 1500 \\ 6000 \\ 8500 \\ 4500 \\ 2000 \\ 1000 \\ +\ \ 500 \\ \hline 24{,}000 \end{array}$$

There were 24,000 finishers.

17. Yes

19. Strategy To find the percent:
- Read the frequency polygon to find how many people purchased between 20 and 30 tickets.
- Solve the basic percent equation for percent. The base is 74 and the amount is the number of people who purchased between 20 and 30 tickets.

Solution Between 20 and 30 tickets: 8

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 74 = 8$$
$$n = 8 \div 74$$
$$n \approx 0.108$$

The percent is 10.8%.

21. Strategy To find the number of students who scored between 1200 and 1400 on the exam, read the frequency polygon.

Solution 170,000 students scored between 1200 and 1400.

23. Strategy To find the number of students:
- Read the frequency polygon to find the number of students who scored between 400 and 600, between 600 and 800, and between 800 and 1,000.
- Add the three numbers.

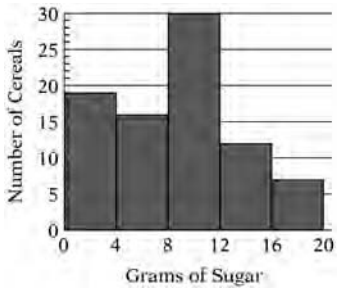
Solution

Between 400 and 600:	30,000
Between 600 and 800:	150,000
Between 800 and 1000:	+ 350,000
	530,000

530,000 students scored below 1000.

Projects or Group Activities

25.



Check Your Progress: Chapter 7

1a. 45 people preferred pepperoni

b. Strategy To find the number of people:

• Read the pictograph to find the number of people who named cheese blend and the number of people who named pineapple.

• Subtract the numbers.

Solution Cheese blend: 65 responses

Pineapple: 25 responses

65 – 25 = 40

40 more people named cheese blend.

c. People named pineapple the least.

2a. Chocolate

b. Strategy To find the number of people who preferred mint chocolate chip:

• Read the circle graph to find the percent of people who named mint chocolate chip as their favorite flavor.

• Solve the basic percent equation for *amount*.

Solution $0.15 \times 1200 = n$

$180 = n$

180 people preferred mint chocolate chip.

c. Strategy To find how many more people chose cookie dough than chose mint chocolate chip:

• Read the circle graph to find the percent of people who named cookie dough as their favorite flavor.

• Solve the basic percent equation for *amount*.

• Use the result from part b and subtract to find the difference.

Solution $0.20 \times 1200 = n$

$240 = n$

240 – 180 = 60

60 more people chose cookie dough.

3a. Strategy To determine whether the population of New York City is more or less than twice the population of Los Angeles:

• Read the bar graph to determine the populations of New York City and Los Angeles.

• Multiply the population of Los Angeles by 2.
• Compare the result to the population of New York City.

Solution New York City: 8.2 million people
Los Angeles: 3.8 million people
$3.8 \times 2 = 7.6$
$8.2 > 7.6$
The population of New York City is more than twice the population of Los Angeles.

b. Strategy To determine whether the population of Los Angeles plus the population of Chicago is more or less than population of New York City:
• Read the bar graph to determine the populations of New York City, Los Angeles, and Chicago.
• Add the populations of Los Angeles and Chicago.
• Compare the result to the population of New York City.

Solution New York City: 8.2 million people
Los Angeles: 3.8 million people
Chicago: 2.8 million people
$3.8 + 2.8 = 6.6$
$6.6 < 8.2$
The population of Los Angeles plus the population of Chicago is less than the population of New York City.

c. Strategy To find the sum of the populations of the three least-populated cities:
• Read the bar graph to determine the cities with the smallest populations.
• Add the populations of these three cities.

Solution Philadelphia: 1.8 million people
Phoenix: 1.6 million people
San Antonio: 1.4 million people
$1.8 + 1.6 + 1.4 = 4.8$
The sum is 4.8 million people.

4a. Ireland

b. Aruba

c. Strategy To find difference
• Read the double-bar graph to determine the amounts for coffee and tea consumption in Japan
• Subtract the values.

Solution Coffee: 120 ounces
Tea: 35 ounces
$120 – 35 = 85$
The difference is 85 ounces.

d. Strategy To determine how many times m ore coffee than tea is consumed per person in the United States:
• Read the double-bar graph to determine the amounts for coffee and tea consumption in the United States.
• Divide the value for coffee by the value for tea.

Solution Coffee: 150 ounces
Tea: 10 ounces
$150 \div 10 = 15$
In the United States, 15 times more coffee than tea is consumed per person.

5a. $600

b. Strategy To find the least increase between consecutive years:
- Find the difference in price between consecutive years.
- Find the least difference.

Solution Between 2006 and 2007
600 – 400 = 200
Between 2007 and 2008
850 – 600 = 250
Between 2008 and 2009
1000 – 850 = 150
Between 2009 and 2010
1200 – 1000 = 200
Between 2010 and 2011
1650 – 1200 = 450
The least increase is between 2008 and 2009.

c. Strategy To find the greatest increase between consecutive years:
- Find the difference in price between consecutive years.
- Find the greatest difference.

Solution Between 2006 and 2007
600 – 400 = 200
Between 2007 and 2008
850 – 600 = 250
Between 2008 and 2009
1000 – 850 = 150
Between 2009 and 2010
1200 – 1000 = 200
Between 2010 and 2011
1650 – 1200 = 450
The greatest increase is between 2010 and 2011.

6a. $1.60

b. 2008

c. 2006, 2008, 2009, and 2010

7a. 14 students waited less than 10 minutes.

b. Strategy To find number of students who sought medical attention during that week:
- Read the values for each time period from the histogram.
- Add the values.

Solution 14 + 26 + 28 + 32 + 24 + 18 + 12 + 6 = 160
160 students sought medical attention.

c. Strategy To determine the percent of students who waited 70 or more minutes:
- Read the values for 70 or more minutes from the histogram.
- Use the total found in part b and solve the basic percent equation for *percent*.

Solution $n \times 160 = 6$
$n = 6 \div 160$
$n = 0.0375$
3.75% of students waited 70 or more minutes.

d. 30-40

8a. 32 professional golfers had an average driving distance of between 285 and 290 yards.

b. **Strategy** To find number of golfers with an average driving distance of over 300 yards:

- Read the values for the number of golfers who had an average driving distance of between 300 and 305 yards and the number of golfers who had an average driving distance of 305 and more yards.
- Add the values.

Solution 15 + 7 = 22

22 professional golfers had an average driving distance of over 300 yards.

c. **Strategy** To determine the percent of golfers who had an average distance of between 290 and 300 yards:

- Read the values for the number of golfers who had an average driving distance of between 290 and 295 yards and the number of golfers who had an average driving distance of between 295 and 300 yards.
- Add the values.
- Find the total number of golfers accounted for in the frequency polygon.
- Solve the basic percent equation for *percent*.

Solution Between 290 and 300 yards: 39 + 46 = 85

All golfers: 15 + 31 + 32 + 39 + 46 + 15 + 7 = 185

$n \times 185 = 85$

$n = 85 \div 185$

$n \approx 0.459$

45.9% of the professional golfers had an average driving distance of between 290 and 300 yards.

Section 7.4

Concept Check

1. The mode must be a value in the data because it is the number that occurs most often in a set of data.

3a. Median

b. Mean

c. Mode

d. Median

e. Mode

f. Mean

Objective A Exercises

5. **Strategy** To find the mean value of the number of seats occupied:

• Find the sum of the number of seats occupied.

• Divide the sum by the number of flights (16).

Solution

309
422
389
412
401
352
367
319
410
391
330
408
399
387
411
+398
6,105

$$16\overline{)6{,}105} \quad 381.5625$$

The mean of the number of seats filled is 381.5625 seats.

Strategy To find the median value of the number of seats occupied, arrange the numbers in order from smallest to largest. The median is the mean of the two middle numbers.

Solution

309
319
330
352 7 numbers
367
387
389
391
398 Middle numbers
399
401
408
410 7 numbers
411
412
422

$$\frac{391+398}{2} = 394.5$$

The median of the number of seats filled is 394.5 seats.

Strategy To find the mode, look at the number of seats occupied and locate the number that occurs most frequently.

Solution Since each number occurs only once, there is no mode.

7. Strategy To find the mean cost:

• Find the sum of the costs.

• Divide the total costs by the number of purchases (8).

Solution

85.89
92.12
81.43
80.67
88.73
82.45
87.81
+ 85.82
684.92

$$8\overline{)684.920} \quad 85.615$$

The mean cost is $85.615.

Strategy To find the median cost, arrange the costs in order from smallest to largest. The median is the mean of the two middle numbers.

Solution

80.67
81.43 3 numbers
82.45
85.82
85.89 middle numbers
87.81
88.73 3 numbers
92.12

$$\frac{85.82 + 85.89}{2} = 85.855$$

The median cost is \$85.855

9. Strategy To find the mean monthly rate:

• Find the sum of the monthly rates.

• Divide the sum by the number of plans (8).

Solution

423
390
405
396
426
355
404
+ 430
3,229

$$8\overline{)3,229.000} \quad 403.625$$

The mean monthly rate is \$403.625.

Strategy To find the median monthly rate, write the rates in order from smallest to largest. The median is the mean of the two middle terms.

Solution

355
390 3 numbers
396
404
405 middle numbers
423
426 3 numbers
430

$$\frac{404 + 405}{2} = 404.50$$

The median monthly rate is \$404.50.

11. Strategy To find the mean life expectancy:

• Find the sum of the years.

• Divide the sum by the number of countries (10).

Solution

73.5
79.1
79.3
75.6
71.2
76.1
74.0
70.1
77
+ 74.4
750.3

$$10\overline{)750.30} \quad 75.03$$

The mean life expectancy is 75.03 years.

Strategy To find the median life expectancy, write the years in order from lowest to highest. The median is the mean of the two middle numbers.

Solution

70.1
71.2
73.5 — 4 numbers
74.0
74.4
75.6 — middle numbers
76.1
77
79.1 — 4 numbers
79.3

$$\frac{74.4 + 75.6}{2} = 75$$

The median life expectancy is 75 years.

13. Strategy To determine which average you would prefer:

• Find the mean of the test scores.

• Find the median of the test scores.

• Choose the higher score.

Solution

Mean	Median	
78	77	
92	78	2 numbers
95		
77	88	
94	92	middle numbers
+ 88	94	
524	95	2 numbers

$$6\overline{)524.0} \quad 87.3$$

$$\frac{88 + 92}{2} = 90$$

You would prefer that the instructor use the higher median score 90.

15. It is 5 more than the mean of the original set.

Objective B Exercises

17. Strategy • Read the lowest value, the highest value, the first quartile, the third quartile, the median directly from the box-and-whiskers plot.

• Find the range by subtracting the lowest from the highest.

• Interquartile range = $Q_3 - Q_1$.

Solution

Lowest is \$37,985.

Highest is \$66,707.

Q_1 = \$44,243

Q_3 = \$55,528

Median = \$49,177

Range: 66,707 – 37,985 = \$28,722

Interquartile range: 55,528 – 44,243 = \$11,285

19a. Strategy To find the number of adults who had a cholesterol level above 217, the median, solve the basic percent equation for the amount, where the base is 80 and the percent is 50%.

Solution

Percent × base = amount

$0.50 \times 80 = 40$

There were 40 adults who had cholesterol levels above 217.

b. Strategy To find the number of adults who had a cholesterol level below 254, the third quartile, solve the basic percent equation for the amount, where the base is 80 and the percent is 75%.

Solution

Percent × base = amount

$0.75 \times 80 = 60$

There were 60 adults who had cholesterol levels below 254.

c. Strategy To find the number of cholesterol levels represented in each quartile, solve the basic percent equation for the amount, where the base is 80 and the percent is 25%.

Solution Percent × base = amount

$0.25 \times 80 = 20$

There are 20 cholesterol levels in each quartile.

d. The first quartile is at 198. So 25% of the adults had cholesterol levels not more than 198.

21a. Strategy

- Arrange the data from smallest to largest.
- Find the range.
- Find Q_1, the median of the lower half of the data.
- Find Q_3, the median of the upper half of the data.
- Interquartile range = $Q_3 - Q_1$.

Solution

0.45	0.47	0.59	0.64	0.81
1.26	1.34	1.52	5.01	6.05

Range: 6.05 – 0.45 = 5.6 emissions

$Q_1 = 0.59$ emissions

$Q_3 = 1.52$ emissions

$$\begin{aligned}\text{Interquartile range} &= Q_3 - Q_1 \\ &= 1.52 - 0.59 \\ &= 0.93 \text{ emissions}\end{aligned}$$

b. $\text{Median} = \dfrac{0.81 + 1.26}{2} = 1.035$

c. 6.05

23a. Strategy To determine whether the difference in means is greater than 1 inch:

- Find the sum of the rainfall in Orlando.
- Divide the sum by the number of months (12) to find the mean.
- Find the sum of the rainfall in Portland.
- Divide the sum by the number of months (12) to find the mean.
- Find the difference in the means.

Solution Orlando

2.1
2.8
3.2
2.2
4.0
7.4
7.8
6.3
5.6
2.8
1.8
+ 1.8
47.8

$$12\overline{)47.8} \quad 4.0$$

Portland

6.2
3.9
3.6
2.3
2.1
1.5
0.5
1.1
1.6
3.1
5.2
+ 6.4
37.5

$$12\overline{)37.5} \quad 3.1$$

$4.0 - 3.1 = 0.9$

No, the difference in the means is not greater than 1 inch.

b. Strategy To find the difference between the medians, write the rainfall in order from lowest to highest. The median is the mean of the two middle numbers. Find the difference between the Orlando median and Portland median.

Solution Orlando

1.8
1.8
2.1 5 numbers
2.2
2.8
2.8
3.2 middle
4.0
5.6
6.3 5 numbers
7.4
7.8

Portland:

0.5
1.1
1.5 5 numbers
1.6
2.1
2.3
3.1 middle
3.6
3.9
5.2 5 numbers
6.2
6.4

For Orlando, $\frac{2.8 + 3.2}{2} = 3.0$

For Portland, $\frac{2.3 + 3.1}{2} = 2.7$

$3.0 - 2.7 = 0.3$

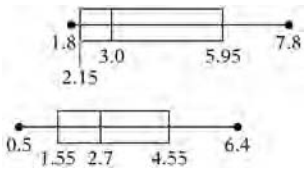
The difference in medians is 0.3 inch.

c. Strategy To draw box-and-whiskers:

- Find Q_1 and Q_3 in Orlando.
- Find Q_1 and Q_3 in Portland.

Solution For Orlando, $Q_1 = \frac{2.1 + 2.2}{2} = 2.15$, $Q_3 = \frac{5.6 + 6.3}{2} = 5.95$

For Portland, $Q_1 = \frac{1.5 + 1.6}{2} = 1.55$, $Q_3 = \frac{3.9 + 5.2}{2} = 4.55$



d. Answers will vary. For example, the distribution of the data is relatively similar for the two cities. However, the value of each of the 5 points on the boxplot for the Portland data is less than the corresponding value on the boxplot for the Orlando data. The average monthly rainfall in Portland is less than the average monthly rainfall in Orlando.

25. Answers will vary. For example, 55, 55, 55, 55, 55, or 50, 55, 55, 55, 60

Critical Thinking

27. Answers will vary. For example, 20, 21, 22, 24, 26, 27, 29, 31, 31, 32, 32, 33, 33, 36, 37, 37, 39, 40, 41, 43, 45, 46, 50, 54, 57

Section 7.5

Concept Check

1. {3, 6, 9}

Objective A Exercises

3. The possible outcomes of tossing a coin four times: {(HHHH), (HHHT), (HHTT), (HHTH), (HTTT), (HTHH), (HTTH), (HTHT), (TTTT), (TTTH), (TTHH), (THHH), (TTHT), (THHT), (THTT), (THTH)}

5. The possible outcomes of tossing two tetrahedral dice: {(1, 1), (1, 2), (1, 3), (1, 4), (2, 1), (2, 2), (2, 3), (2, 4), (3, 1), (3, 2), (3, 3), (3, 4), (4, 1), (4, 2), (4, 3), (4, 4)}

7. The sample space is {1, 2, 3, 4, 5, 6, 7, 8}.

9a. **Strategy** To calculate the probability:
- Count the number of possible outcomes. See the table on p. 328.
- Count the number of favorable outcomes.
- Use the probability formula.

Solution There are 36 possible outcomes.

There are 4 favorable outcomes: (1, 4), (4, 1), (2, 3), (3, 2).

$\text{Probability} = \frac{4}{36} = \frac{1}{9}$

The probability that the sum is 5 is $\frac{1}{9}$.

b. **Strategy** To calculate the probability:
- Count the number of possible outcomes. See the table on p. 328.
- Count the number of favorable outcomes.
- Use the probability formula.

Solution There are 36 possible outcomes.

There are 0 favorable outcomes.

$$\text{Probability} = \frac{0}{36} = 0$$

The probability that the sum is 15 is 0.

c. **Strategy** To calculate the probability:

• Count the number of possible outcomes. See the table on p. 328.

• Count the number of favorable outcomes.

• Use the probability formula.

Solution There are 36 possible outcomes.

There are 36 favorable outcomes.

$$\text{Probability} = \frac{36}{36} = 1$$

The probability that the sum is less than 15 is 1.

11a. **Strategy** To calculate the probability:

• Count the number of possible outcomes. Refer to Exercise 3.

• Count the number of favorable outcomes.

• Use the probability formula.

Solution There are 16 possible outcomes.

There are 3 favorable outcomes: (1, 3), (3, 1), (2, 2).

$$\text{Probability} = \frac{3}{16}$$

The probability is $\frac{3}{16}$ that the sum of the dots on the two dice is 4.

b. **Strategy** To calculate the probability:

• Count the number of possible outcomes. Refer to Exercise 3.

• Count the number of favorable outcomes.

• Use the probability formula.

Solution There are 16 possible outcomes.

There are 3 favorable outcomes: (2, 4), (4, 2), (3, 3).

$$\text{Probability} = \frac{3}{16}$$

The probability is $\frac{3}{16}$ that the sum of the dots on the two dice is 6.

13. **Strategy** To calculate the probability:

• Count the number of possible outcomes. See the table on p. 328.

• Count the number of favorable outcomes.

• Use the probability formula.

• Compare the probabilities.

Solution There are 36 possible outcomes.

For a sum of 10, there are 3 favorable outcomes: (5, 5), (4, 6), (6, 4).

$$\text{Probability} = \frac{3}{36}$$

For a sum of 5, there are 4 favorable outcomes: (1, 4), (4, 1), (2, 3), (3, 2).

$$\text{Probability} = \frac{4}{36}$$

$$\frac{4}{36} > \frac{3}{36}$$

The probability of throwing a sum of 5 is greater.

15. **Strategy** To calculate the probability:
• Count the number of possible outcomes.
• Count the number of favorable outcomes.
• Use the probability formula.
• Compare the probabilities.

Solution There are 12 possible outcomes.
There are 3 favorable outcomes of choosing a blue marble.

$$\text{Probability} = \frac{3}{12} = \frac{1}{4}$$

There are 5 favorable outcomes of choosing a red marble.

$$\text{Probability} = \frac{5}{12}$$

$$\frac{5}{12} > \frac{3}{12}$$

The probability of choosing a red marble is greater.

17. **Strategy** To calculate the empirical probability, use the probability formula and divide the number of observations (37) by the total number of observations (95).

Solution

$$\text{Probability} = \frac{37}{95} \approx 0.39$$

The probability is 0.39 that a person prefers a cash discount.

19. **Strategy** To calculate the probability:
• Count the number of possible outcomes.
• Count the number of favorable outcomes.
• Use the probability formula.

Solution There are 377 (98 + 87 + 129 + 42 + 21) possible outcomes.
There are 185 (98 + 87) favorable outcomes.

$$\text{Probability} = \frac{185}{377}$$

The probability is $\frac{185}{377}$ that the customer rated the cable service satisfactory or excellent.

Projects or Group Activities

21a. 56

b. 2 tails means 6 heads occurred; 28

c. 1 + 8 + 28 + 56 + 70 + 56 + 28 + 8 + 1 = 256

d. $\frac{70}{256} = \frac{35}{128}$

e. 7 tails means 1 head occurred; $\frac{8}{256} = \frac{1}{32}$

f. 56 + 28 + 8 + 1 = 93; $\frac{93}{256}$

g. 8 + 28 + 56 + 70 + 56 + 28 + 8 + 1 = 255; $\frac{255}{256}$

h. 1

Chapter 7 Review Exercises

1. **Strategy** To find the amount of money:
• Read the circle graph to determine the amounts of money spent.
• Add the amounts.

Solution

Defense:	148 million
Agriculture:	15 million
EPA:	24 million
Commerce:	27 million
NASA:	31 million
Other:	+ 104 million
	349 million

The agencies spent $349 million in maintaining websites.

2. Strategy To find the ratio:

• Read the circle graph to find the amount spent by the Department of Commerce and by the EPA.

• Write, in simplest form, the ratio of the amount spent by the Department of Commerce to the amount spent by the EPA.

Solution

Commerce: $27 million

EPA: $24 million

$$\frac{\$27 \text{ million}}{\$24 million} = \frac{9}{8}$$

The ratio is $\frac{9}{8}$.

3. Strategy To find the percent, solve the basic percent equation for percent. The base is the total amount spent ($349 million) and the amount is the amount spent by NASA ($31 million)

Solution

Percent × base = amount

$n \times 349 \text{ million} = 31 \text{ million}$

$$n = \frac{31 \text{ million}}{349 \text{ million}}$$

$$n \approx 0.0888$$

8.9% of the total mount of money was spent by NASA.

4. Texas had the larger population.

5. Strategy To find the difference in populations:

• Read the double broken-line graph to find the Texas population and the California population in 2000.

• Subtract the population of Texas from the population of California.

Solution

California :	32.5
Texas :	–20.0
	12.5

The population of California is 12.5 million people more than the population of Texas.

6. Strategy To find which 25-year period Texas had the smallest increase in population.

• Read the double-line graph to find the population for each 25-year period.

• Subtract the two numbers.

Solution

1900 to 1925:

6 – 2.5 = 3.5 million

1925 to 1950:

8 – 6 = 2 million

1950 to 1975:

12 – 8 = 4 million

1975 to 2000:

21 – 12 = 9 million

The Texas population increased the least from 1925 to 1950.

7. Strategy To find the number of games in which the Knicks scored fewer than 100 points:

• Read the frequency

polygon to find the number of games in which the Knicks scored 60–70 points, 70–80 points, 80–90 points, and 90–100 points.

• Add the four numbers.

Solution

60 – 70 points: 1 game
70 – 80 points: 7 games
80 – 90 points: 15 games
90 – 100 points: + 31 games
54

There were 54 games in which the Knicks scored fewer than 100 points.

8. Strategy To find the ratio:

• Read the frequency polygon to find the number of games in which the Knicks scored between 90 and 100 points and between 110 and 120 points.

• Write in simplest form the ratio of the number of games in which the Knicks scored between 90 and 100 points to the number of games in which they scored between 110 and 120 points.

Solution

90 to 100 points : 31 games
110 to 120 points : 8 games

$$\frac{31 \text{ games}}{8 \text{ games}} = \frac{31}{8}$$

The ratio is $\frac{31}{8}$.

9. Strategy To find the percent:

• Read the frequency polygon to find the number of games in which the Knicks scored 110 to 120 points and 120 to 130 points.

• Add the two numbers.

• Solve the basic percent equation for percent. The base is 80 and the amount is the number of games in which more than 110 points were scored.

Solution

110 – 120 points: 8 games
120 – 130 points: + 1 game
9 games

Percent × base = amount
$n \times 80 = 9$
$n = 9 \div 80$
$n = 0.1125$

The percent is 11.3%.

10. From the pictograph, O'Hare airport has 10 million more passengers than Los Angeles airport.

11. Strategy To find the ratio:

• Read the pictograph to find the number of passengers going through Hartsfield airport and the number of passengers going through Dallas/ Ft. Worth airport.

• Write in simplest form the ratio of the number of passengers going through Hartsfield airport to the number of passengers going through Dallas/Ft. Worth airport.

Solution

Hartsfield: 40
Dallas/Ft: Worth: 30

$$\frac{40}{30} = \frac{4}{3} = 4 : 3$$

The ratio is 4 : 3.

12. Strategy To find the difference between the total days of operation and days of full operation of the Midwest ski areas:

• Read the double-bar graph for the number of days that the resorts were open and the days of full operation.

• Subtract the two numbers.

Solution

Days open:	90
Days of full operation:	− 40
	50

The difference was 50 days.

13. Strategy To find the percent:

• Read the double-bar graph to find the number of days that the Rocky Mountain ski areas were open and the number of days of full operation.

• Solve the basic percent equation for percent. The base is the number of days open and the amount is the number of days of full operation.

Solution Days open: 140

Days of full operation: 70

Percent × base = amount

$$n \times 140 = 70$$

$$n = 70 \div 140$$

$$n = 0.5$$

The percent is 50%.

14. Strategy To determine which region has the lowest number of days of full operation, read the bar graph and select the lowest graph that shows days of full operation.

Solution The Southeast had the lowest number of days of full operation.

Strategy Read the number of days from the lowest graph.

Solution This region had 30 days of full operation.

15. Strategy To calculate the probability:

• Count the number of possible outcomes.

• Count the number of favorable outcomes.

• Use the probability formula.

Solution There are 16 possible outcomes.

There are 4 favorable outcomes: THHH, HHHT, HHTH, HTHH.

$$\text{Probability} = \frac{4}{16} = \frac{1}{4}$$

The probability of one tail and three heads is $\frac{1}{4}$.

16. Strategy To find the number of people who slept 8 hours or more:

• Read the histogram to find the number of people who slept 8 hours, 9 hours, or more than 9 hours.

• Add the three numbers.

Solution

Slept 8 hours:	12
Slept 9 hours:	2
Slept more than 9 hours:	+ 1
	15

There were 15 people who slept 8 or more hours.

17. Strategy To find the percent:

- Read the histogram to find the number of people who slept 7 hours.
- Solve the basic percent equation for percent. The base is 46 and the amount is the number of people who slept 7 hours.

Solution Slept 7 hours: 13

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 46 = 13$$
$$n = 13 \div 46$$
$$n \approx 0.2826$$

The percent is 28.3%.

18a. Strategy To find the mean heart rates:

- Find the sum of the heart rates.
- Divide the sum by the number of women (24).

Solution

$$\begin{array}{r} 80 \\ 82 \\ 99 \\ 91 \\ 93 \\ 87 \\ 103 \\ 94 \\ 73 \\ 96 \\ 86 \\ 80 \\ 97 \\ 94 \\ 108 \\ 81 \\ 100 \\ 109 \\ 91 \\ 84 \\ 78 \\ 96 \\ 96 \\ +\ 100 \\ \hline 2198 \end{array}$$

$$24\overline{)2198.00} \quad 91.58 \approx 91.6$$

$$\begin{array}{r} -216 \\ \hline 38 \\ -24 \\ \hline 140 \\ -120 \\ \hline 200 \\ -192 \\ \hline 8 \end{array}$$

The mean heart rate is 91.6 heartbeats per minute.

Strategy To find the median heart rate: write the heart rates in order from smallest to largest. The median is the mean of the two middle numbers.

Solution

73
78
80
80
81
82 11 numbers
84
86
87
91
91
93
94 middle numbers
94
96
96
96
97
99 11 numbers
100
100
103
108
109

$$\frac{93 + 94}{2} = 93.5$$

The median heart rate is 93.5 heartbeats per minute.

Strategy To find the mode, look at the heart rates and identify the number that occurs most frequently.

Solution The mode is 96 heartbeats per minute, the number that occurs most frequently.

b. **Strategy**

- Arrange the data from smallest to largest. Then find the range.
- Find Q_1, the median of the lower half of the data.
- Find Q_3, the median of the upper half of the data.
- Interquartile range = $Q_3 - Q_1$.

Solution Use the list in part a.

Range = 109 – 73 = 36

The range is 36 heartbeats per minute.

$$Q_1 = \frac{82 + 84}{2} = 83$$

$$Q_3 = \frac{97 + 99}{2} = 98$$

$$Q_3 - Q_1 = 98 - 83 = 15$$

The interquartile range is 15 heartbeats per minute.

Chapter 7 Test

1. **Strategy** To find the number of students who spent between \$45 and \$75 each week:

- Read the frequency polygon to find the number of students who spent between \$45 and \$60 and the number who spent between \$60 and \$75.
- Add the two numbers.

Solution

Number between \$45 – \$60:	12
Number between \$60 – \$75:	+ 7
	19

19 students spent between \$45 and \$75 each week.

2. **Strategy** To find the ratio:

• Read the frequency polygon to find the number of students who spent between $30 and $45 and the number who spent between $45 and $60.

• Write in simplest form the ratio of the number of students who spent between $30 and $45 to the number of students who spent between $45 and $60.

Solution Between $30 and $45: 8 students

Between $45 and $60: 12 students

$$\frac{8 \text{ students}}{12 \text{ students}} = \frac{2}{3}$$

The ratio is $\frac{2}{3}$.

3. **Strategy** To find the percent:

• Read the frequency polygon to find the number of students who spent between $0 to $15, between $15 and $30, and between $30 and $45 each week.

• Add the three numbers.

• Solve the basic percent equation for percent. The base is 40 and the amount is the number of students who spent less than $45 per week.

Solution

Between $0 and $15:	4 students
Between $15 and $30:	6 students
Between $30 and $45:	+ 8 students
	18 students

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 40 = 18$$
$$n = 18 \div 40$$
$$n = 0.45$$

The percent is 45%.

4. **Strategy** To find the number of people surveyed:

• Read the pictograph to determine the number of people for each letter grade.

• Add the four numbers.

Solution

Number of A grades:	21
Number of B grades:	10
Number of C grades:	4
Number of D grades:	+ 1
	36

There were 36 people that were surveyed for the Gallup poll.

5. **Strategy** To find the ratio:

• Read the pictograph to find the number of people who gave their marriage a B grade and the number who gave their marriage a C grade.

• Write in simplest form the ratio of the number of people who gave their marriage a B grade to the number of people who gave their marriage a C grade.

Solution Number of B grades: 10 people

Number of C grades: 4 people

$$\frac{10 \text{ people}}{4 \text{ people}} = \frac{5}{2}$$

The ratio is $\frac{5}{2}$.

6. **Strategy** To find the percent:

• Read the pictograph to find the number of people who gave

their marriage an A grade.

• Solve the basic percent equation for percent. The base is 36 (from Exercise 4) and the amount is the number of people who gave their marriage an A grade.

Solution Number of A grades: 21 people

Percent × base = amount

$n \times 36 = 21$

$n = 21 \div 36$

$n \approx 0.583$

The percent is 58.3%.

7. Strategy Read the bar graph to find the two consecutive years that the number of fatalities were the same.

Solution During 1995 and 1996, the number of fatalities was the same.

8. Strategy To find the total fatalities on amusement rides during 1991 to 1999:

• Read the bar graph to determine the number of fatalities for each year.

• Add the nine numbers.

Solution

3	1991
2	1992
4	1993
2	1994
3	1995
3	1996
4	1997
5	1998
+ 6	1999
32	

There were 32 fatal accidents from 1991 to 1999.

9. Strategy To find how many more fatalities in 1995 to 1998 than 1991 to 1994:

• Add the number of fatalities for 1995 to 1998.

• Add the number of fatalities for 1991 to 1994.

• Subtract the two numbers.

Solution

3	1995	3	1991
3	1996	2	1992
4	1997	4	1993
+ 5	1998	+ 2	1994
15		11	

$15 - 11 = 4$

There were 4 more fatalities from 1995 to 1998.

10. Strategy To find how many more R-rated films than PG:

• Read the circle graph to find the number of films rated R and PG.

• Subtract the two numbers.

Solution

R: 427

PG: − 72

355

There were 355 more films rated R.

11. Strategy To find how many times more PG-13 films were released than NC-17:

• Read the circle graph to find the number of films rated PG-13 and NC-17.

• Divide the two numbers.

Solution PG-13: 112

NC-17: 7

$7\overline{)112}$ 16

There were 16 times more films rated PG-13.

12. Strategy To find the percent of films rated G:

• Read the circle graph to find the number of G-rated films.

• Write and solve the basic percent equation for the percent. The base is the total number of films (655) and the amount is the number of G-rated films.

Solution G: 37

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 655 = 37$$
$$n = 37 \div 655$$
$$n \approx 0.056$$

The percent of films rated G was 5.6%.

13. Strategy To find the number of states with median income between \$40,000 and \$60,000.

• Read the histogram to find the number of states with per capita income between \$40,000 and \$50,000 and between \$50,000 and \$60,000.

• Add the two numbers.

Solution

\$40,000 to \$50,000:	23 states
\$50,000 to \$60,000:	+ 16 states
	39 states

There are 39 states that have a median income between \$40,000 and \$60,000.

14. Strategy To find the percent of the states with a median income between \$50,000 and \$70,000:

• Read the histogram to find the number of states with median incomes between \$50,000 and \$60,000 and between \$60,000 and \$70,000.

• Add the two numbers.

• Solve the basic percent equation for percent. The base is 50 and the amount is the number of states with a median income between \$50,000 and \$70,000.

Solution

\$50,000 to \$60,000:	16 states
\$60,000 to \$70,000:	+ 7 states
	23 states

$$\text{Percent} \times \text{base} = \text{amount}$$
$$n \times 50 = 23$$
$$n = 23 \div 50$$
$$n = 0.46$$

The percent is 46%.

15. Strategy To find the percent:

• Read the histogram to find the number of states that have a median income that is \$40,000 or less.

• Solve the basic percent equation for percent. The base is 50 and the amount is the number of states with a median income above \$70,000.

Solution \$40,000 or less: 4 states

Percent × base = amount
$n \times 50 = 4$
$n = 4 \div 50$
$n = 0.08$

The percent is 8%.

16. Strategy To find which decade had the smallest increase in enrollment.

• Read the line graph to find the enrollment for each decade.

• Subtract the two numbers.

Solution 1960 to 1970:

8 – 4 = 4 million

1970 to 1980:

12 – 8 = 4 million

1980 to 1990:

14 – 12 = 2 million

1990 to 2000:

15 – 14 = 1 million

The student enrollment increased the least during the 1990s.

17. Strategy To approximate the increase in enrollment:

• Read the enrollment for 1960 and 2010.

• Subtract the two numbers.

Solution

2010: 21 million
1960: – 4 million
17 million

The increase in enrollment was 17 million students.

18. Strategy To calculate the probability:

• Count the number of possible outcomes.

• Count the number of favorable outcomes.

• Use the probability formula.

Solution There are 50 possible outcomes.

There are 15 favorable outcomes.

$$\text{Probability} = \frac{15}{50} = \frac{3}{10}$$

The probability is $\frac{3}{10}$ that the ball chosen is red.

19a. Strategy To find the mean lifetime of the batteries:

• Find the sum of the times.

• Divide the sum by the number of batteries tested (20).

Solution

2.9
2.4
3.1
2.5
2.6
2.0
3.0
2.3
2.4
2.7
2.0
2.4
2.6
2.7
2.1
2.9
2.8
2.4
2.0
+ 2.8
50.6

$$20\overline{)50.60}\quad 2.53$$

The mean time is 2.53 hours.

b. Strategy To find the median lifetime of the batteries, write times in

order from lowest to highest. The median is the mean of the two middle numbers.

Solution

2.0
2.0
2.0
2.1
2.3 9 numbers
2.4
2.4
2.4
2.4
2.5
2.6 middle numbers
2.6
2.7
2.7
2.8
2.8 9 numbers
2.9
2.9
3.0
3.1

$$\frac{2.5 + 2.6}{2} = 2.55$$

The median time is 2.55 hours.

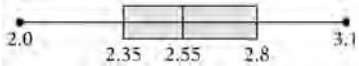
c. Strategy The data is arranged from smallest to largest in part b.

- Find Q_1, the median of the lower half of the data.
- Find Q_3, the median of the upper half of the data.
- Draw the box-and-whiskers plot.

Solution

$$Q_1 = \frac{2.3 + 2.4}{2} = 2.35$$

$$Q_3 = \frac{2.8 + 2.8}{2} = 2.8$$



Cumulative Review Exercises

1. $2^2 \cdot 3^3 \cdot 5 = (2 \cdot 2) \cdot (3 \cdot 3 \cdot 3) \cdot (5)$
$= 4 \cdot 27 \cdot 5 = 540$

2. $3^2 \cdot (5 - 2) \div 3 + 5$
$= 9 \cdot (3) \div 3 + 5$
$= 27 \div 3 + 5$
$= 9 + 5$
$= 14$

3.

	2	3	5
24 =	$2 \cdot 2 \cdot 2$	3	
40 =	$2 \cdot 2 \cdot 2$		5

$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 = 120$

4. $\frac{60}{144} = \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot 5}{\underset{1}{2} \cdot \underset{1}{2} \cdot 2 \cdot 2 \cdot \underset{1}{3} \cdot 3} = \frac{5}{12}$

5.
$$\begin{array}{r} 4\frac{1}{2} = 4\frac{20}{20} \\ 2\frac{3}{8} = 2\frac{15}{40} \\ +5\frac{1}{5} = 5\frac{5}{40} \\ \hline 11\frac{43}{40} = 12\frac{3}{40} \end{array}$$

6.
$$\begin{array}{r} 12\frac{5}{8} = 12\frac{15}{24} = 11\frac{39}{24} \\ -7\frac{11}{12} = 7\frac{22}{24} = 7\frac{22}{24} \\ \hline 4\frac{17}{24} \end{array}$$

7. $\frac{5}{8} \times 3\frac{1}{5} = \frac{5}{8} \times \frac{16}{5}$
$= \frac{5 \cdot 16}{8 \cdot 5}$
$= \frac{\overset{1}{5} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot 2}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{5}} = 2$

8. $3\frac{1}{5} \div 4\frac{1}{4} = \frac{16}{5} \div \frac{17}{4} = \frac{16}{5} \times \frac{4}{17} = \frac{16 \cdot 4}{5 \cdot 17} = \frac{64}{85}$

9. $\frac{5}{8} \div \left(\frac{3}{4} - \frac{2}{3}\right) + \frac{3}{4} = \frac{5}{8} \div \left(\frac{9}{12} - \frac{8}{12}\right) + \frac{3}{4}$

$$= \frac{5}{8} \div \frac{1}{12} + \frac{3}{4}$$

$$= \frac{5}{8} \times \frac{12}{1} + \frac{3}{4}$$

$$= \frac{5 \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot 3}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 2} + \frac{3}{4}$$

$$= \frac{15}{2} + \frac{3}{4} = \frac{30}{4} + \frac{3}{4} = \frac{33}{4} = 8\frac{1}{4}$$

10. 209.305

11.
$$\begin{array}{r} 4.092 \\ \times\ 0.69 \\ \hline 36828 \\ 24552 \\ \hline 2.82348 \end{array}$$

12. $16\frac{2}{3} = \frac{50}{3} \approx 16.\overline{6}$

$$\begin{array}{r} 16.666 \\ 3\overline{)50.000} \\ -3 \\ \hline 20 \\ -18 \\ \hline 20 \\ -18 \\ \hline 20 \\ -18 \\ \hline 20 \\ -18 \\ \hline 20 \end{array}$$

13. $\frac{330 \text{ miles}}{12.5 \text{ gal}} = 26.4 \text{ miles/gallon}$

14. $\frac{n}{5} = \frac{16}{55}$

$n \times 25 = 5 \times 16$

$n \times 25 = 80$

$n = 80 \div 25 = 3.2$

15. $\frac{4}{5} \times 100\% = 80\%$

16. $10\% \times n = 8$

$0.10 \times n = 8$

$n = 8 \div 0.10 = 80$

17. $38\% \times 43 = n$

$0.38 \times 43 = n$

$16.34 = n$

18. $n \times 75 = 30$

$n = 30 \div 75 = 0.40 = 40\%$

19. **Strategy** To find the income for the week:

- Find the commission earned on sales by solving the basic percent equation for amount. The base is \$27,500 and the percent is 2%.
- Find the total income by adding the base salary (\$100) to the commission.

Solution $2\% \times 27{,}500 = n$

$0.02 \times 27{,}500 = n$

$550 = n$

$100 + 550 = 650$

The salesperson's income for the week was \$650.

20. **Strategy** To find the cost, write and solve a proportion.

Solution $\frac{8.15}{1000} = \frac{n}{50{,}000}$

$8.15 \times 50{,}000 = n \times 1000$

$407{,}500 = n \times 1000$

$407{,}500 \div 1000 = n$

$407.50 = n$

The cost is \$407.50.

21. **Strategy** To find the interest due, multiply the principal by the annual interest rate and the time (in years).

Solution

$$125{,}000 \times 0.06 \times \frac{6}{12} = 3750$$

The interest due is \$3750.

22. Strategy To find the markup rate of the compact disc player:

• Find the markup amount by subtracting the cost (\$180) from the selling price (\$279).

• Solve the basic percent equation for percent. The base is \$180 and the amount is the amount of the markup.

Solution $279 - 180 = 99$

$$\begin{aligned} \text{Percent} \times \text{base} &= \text{amount} \\ n \times 180 &= 99 \\ n &= 99 \div 180 \\ &= 0.55 = 55\% \end{aligned}$$

The markup rate is 55%.

23. Strategy To find how much is budgeted for food:

• Read the circle graph to find what percent of the budget is spent on food.

• Solve the basic percent equation for amount. The base is \$4500 and the rate is the percent of the budget that is spent on food.

Solution Amount spent on food: 19%

$$\begin{aligned} \text{Percent} \times \text{base} &= \text{amount} \\ 19\% \times 4500 &= \text{amount} \\ 0.19 \times 4500 &= 855 \end{aligned}$$

The amount budgeted for food is \$855.

24. Strategy To find the difference:

• Read the double-broken-line graph to find the number of problems student 1 answered correctly on test 1 and the number of problems student 2 answered correctly on test 1.

• Subtract the student 1 total from the student 2 total to find the difference.

Solution

$$\begin{array}{rl} \text{student 2:} & 27 \text{ answered correctly} \\ \text{student 1:} & -15 \text{ answered correctly} \\ \hline & 12 \text{ answered correctly} \end{array}$$

The difference in the number answered correctly is 12 problems.

25. Strategy To find the mean high temperature:

• Find the sum of the high temperatures.

• Divide the sum of the high temperatures by the number of temperatures (7).

Solution

$$\begin{array}{r} 56^\circ \\ 72^\circ \\ 80^\circ \\ 75^\circ \\ 68^\circ \\ 62^\circ \\ +\ 74^\circ \\ \hline 487^\circ \end{array}$$

$$7\overline{)487.00} \quad 69.57$$

The mean high temperature is 69.6°F.

26. Strategy To calculate the probability:

• Count the number of possible outcomes.

• Count the number of favorable outcomes.

• Use the probability formula.

Solution There are 36 possible outcomes. There are 5 favorable outcomes: (2, 6), (6, 2), (3, 5), (5, 3), (4, 4).

$$\text{Probability} = \frac{5}{36}$$

The probability is $\frac{5}{36}$ that the sum of the dots on the two dice is 8.

Chapter 8: U.S. Customary Units of Measurement

Prep Test

1. $\begin{array}{r} 485 \\ +217 \\ \hline 702 \end{array}$

2. $\begin{array}{r} 145 \\ -87 \\ \hline 58 \end{array}$

3. $36 \times \frac{1}{9} = 4$

4. $\frac{5}{3} \times 6 = \frac{5}{3} \times \frac{6}{1} = \frac{5 \cdot \overset{1}{2} \cdot \cancel{3}}{\underset{1}{\cancel{3}}} = 10$

5. $400 \times \frac{1}{8} \times \frac{1}{2} = \frac{400}{1} \times \frac{1}{8} \times \frac{1}{2}$

$= \frac{\overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot \overset{1}{2} \cdot 5 \cdot 5}{\underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2} \cdot \underset{1}{2}}$

$= 25$

6. $5\frac{3}{4} \times 8 = \frac{23}{4} \times \frac{8}{1} = \frac{23 \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot 2}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}}} = 46$

7. $3\overline{)714}$ $\quad 238$

8. $12\overline{)18.0}$ $\quad 1.5$

Section 8.1

Concept Check

1. A conversion rate is a rate that is used to change from one unit of measurement to another unit.

Objective A Exercises

3. Greater than

5. Greater than

7. $9 \text{ ft} = 9 \cancel{\text{ft}} \times \frac{12 \text{ in.}}{1 \cancel{\text{ft}}} = 108 \text{ in.}$

9. $64 \text{ in.} = 64 \cancel{\text{in.}} \times \frac{1 \text{ ft}}{12 \cancel{\text{in.}}} = 5\frac{1}{3} \text{ ft}$

11. $\frac{1}{2} \text{ mi} = \frac{1}{2} \cancel{\text{mi}} \times \frac{5280 \cancel{\text{ft}}}{1 \cancel{\text{mi}}} \times \frac{1 \text{ yd}}{3 \cancel{\text{ft}}}$

$= 880 \text{ yd}$

13. $3\frac{1}{2} \text{ yd} = \frac{7}{2} \cancel{\text{yd}} \times \frac{36 \text{ in.}}{1 \cancel{\text{yd}}} = 126 \text{ in.}$

15. $5 \text{ yd} = 5 \cancel{\text{yd}} \times \frac{36 \text{ in.}}{1 \cancel{\text{yd}}} = 180 \text{ in.}$

17. $7920 \text{ ft} = 7920 \cancel{\text{ft}} \times \frac{1 \text{ mi}}{5280 \cancel{\text{ft}}}$

$= \frac{3}{2} \text{ mi} = 1\frac{1}{2} \text{ mi}$

Objective B Exercises

19. 5280

21. $5280\overline{)6400}$ $\quad 1 \text{ mi } 1120 \text{ ft}$

$\underline{-5280}$

1120

6400 ft = 1 mi 1120 ft

23. $\begin{array}{r} 9 \text{ ft } 11 \text{ in.} \\ +\ 3 \text{ ft } \ 6 \text{ in.} \\ \hline 12 \text{ ft } 17 \text{ in.} = 13 \text{ ft } 5 \text{ in.} \end{array}$

25. $4\frac{2}{3}\text{ ft} + 6\frac{1}{2}\text{ ft} = 4\frac{4}{6}\text{ ft} + 6\frac{3}{6}\text{ ft}$

$= 10\frac{7}{6}\text{ ft}$

$= 11\frac{1}{6}\text{ ft}$

27.
$$\begin{array}{r} 8\text{ yd }\ 4\text{ ft} \\ 9\ \cancel{\text{yd}}\ 1\ \cancel{\text{ft}} \\ -3\text{ yd }\ 2\text{ ft} \\ \hline 5\text{ yd }\ 2\text{ ft} \end{array}$$

29. $3\frac{2}{3}\text{ ft} \times 4 = \frac{11}{3}\text{ ft} \times 4$

$= \frac{44}{3}\text{ ft}$

$= 14\frac{2}{3}\text{ ft}$

31. $12\frac{1}{2}\text{ in.} \div 3 = 12\frac{1}{2}\text{ in.} \times \frac{1}{3}$

$= \frac{25}{2}\text{ in.} \times \frac{1}{3}$

$= \frac{25}{6}\text{ in.}$

$= 4\frac{1}{6}\text{ in.}$

Objective C Exercises

33. **Strategy** To find the number of feet of material used, convert the number of yards of material used (32) to feet.

Solution $32\text{ yd} = 32\ \cancel{\text{yd}} \times \frac{3\text{ ft}}{1\ \cancel{\text{yd}}} = 96\text{ ft}$

96 ft of materials were used.

35. **Strategy** To find the total length of the shaft, add the three lengths (6 in., 1 ft 5 in., 1 ft 2 in.).

Solution
$$\begin{array}{r} 6\text{ in.} \\ 1\text{ ft }\ 5\text{ in.} \\ +\ 1\text{ ft }\ 2\text{ in.} \\ \hline 2\text{ ft }13\text{ in.} = 3\text{ ft }1\text{ in.} \end{array}$$

The total length is 3 ft 1 in.

37. **Strategy** To find the missing dimension:

• Find the sum of the four given dimensions

$\frac{1}{2}, \frac{3}{4}, \frac{3}{4}, \text{and } \frac{1}{2}\text{in.}$.

• Subtract the sum of the four given dimensions from the total length (4 in.).

Solution
$$\begin{array}{r} \frac{1}{2}\text{ in.} = \frac{2}{4}\text{ in.} \\ \frac{3}{4}\text{ in.} = \frac{3}{4}\text{ in.} \\ \frac{3}{4}\text{ in.} = \frac{3}{4}\text{ in.} \\ +\ \frac{1}{2}\text{ in.} = \frac{2}{4}\text{ in.} \\ \hline \frac{10}{4}\text{ in.} = \frac{5}{2}\text{ in.} \\ = 2\frac{1}{2}\text{ in.} \end{array}$$

$4\text{ in.} = 3\frac{2}{2}\text{ in.}$

$-\ 2\frac{1}{2}\text{ in.} = 2\frac{1}{2}\text{ in.}$

$1\frac{1}{2}\text{ in.}$

The missing dimension is $1\frac{1}{2}\text{ in.}$

39. **Strategy** To find the total length of the board, multiply the length of each cut piece (3 ft 4 in.) by the number of equal pieces (4).

Solution
$$\begin{array}{r} 3\text{ ft }\ 4\text{ in.} \\ \times \qquad 4 \\ \hline 12\text{ ft }16\text{ in.} = 13\text{ ft }4\text{ in.} \end{array}$$

The board must be 13 ft 4 in. long.

41. **Strategy** To find the number of inches of baseboard you purchased, convert the number of feet of baseboard (32) to inches.

Solution $32 \text{ ft} = 32 \cancel{\text{ ft}} \times \dfrac{12 \text{ in.}}{1 \cancel{\text{ ft}}} = 384 \text{ in.}$

You purchased 384 in. of baseboard.

43. **Strategy** To find the total number of feet of material needed to build the rafters:

- Multiply the length of each rafter (8 ft 4 in.) by the number of rafters (9) to find the total length.
- Convert the length in inches to feet.

Solution

$$\begin{array}{r} 8 \text{ ft} \quad 4 \text{ in.} \\ \times \qquad 9 \\ \hline 72 \text{ ft } 36 \text{ in.} = 75 \text{ ft} \end{array}$$

The total length of material needed is 75 ft.

45. True; if the ribbon is 15 ft long and cut into five equal pieces, then each piece is 3 ft, or 2 ft 12 in., which is not the case.

Projects or Group Activities

47a. 1 furlong = 40 rods

b. 1 fathom = 6 ft

c. 1 rod = $5\frac{1}{2}$ yd

Section 8.2

Concept Check

1. Less than

3a. $\dfrac{2000 \text{ lb}}{1 \text{ ton}}$

b. $\dfrac{1 \text{ lb}}{16 \text{ oz}}$

Objective A Exercises

5. $36 \text{ oz} = 36 \cancel{\text{ oz}} \times \dfrac{1 \text{ lb}}{16 \cancel{\text{ oz}}} = 2\frac{1}{4} \text{ lb}$

7. $7 \text{ lb} = 7 \cancel{\text{ lb}} \times \dfrac{16 \text{ oz}}{1 \cancel{\text{ lb}}} = 112 \text{ oz}$

9. $9000 \text{ lb} = 9000 \cancel{\text{ lb}} \times \dfrac{1 \text{ ton}}{2000 \cancel{\text{ lb}}} = 4\frac{1}{2} \text{ tons}$

11. $1\frac{1}{4} \text{ tons} = 1\frac{1}{4} \cancel{\text{ tons}} \times \dfrac{2000 \text{ lb}}{1 \cancel{\text{ ton}}} = 2500 \text{ lb}$

13. $90 \text{ oz} = 90 \cancel{\text{ oz}} \times \dfrac{1 \text{ lb}}{16 \cancel{\text{ oz}}} = 5\frac{5}{8} \text{ lb}$

15. $2\frac{5}{8} \text{ lb} = 2\frac{5}{8} \cancel{\text{ lb}} \times \dfrac{16 \text{ oz}}{1 \cancel{\text{ lb}}} = 42 \text{ oz}$

17. $5000 \text{ lb} = 5000 \cancel{\text{ lb}} \times \dfrac{1 \text{ ton}}{2000 \cancel{\text{ lb}}} = 2\frac{1}{2} \text{ tons}$

Objective B Exercises

19. 2000

21.

$$\begin{array}{r} \quad\quad 4 \text{ tons } 1000 \text{ lb} \\ 2000\overline{)9000} \\ \underline{-8000} \\ 1000 \end{array}$$

9000 lb = 4 tons 1000 lb

23.

$$\begin{array}{r} 4 \text{ lb } 7 \text{ oz} \\ \underline{+3 \text{ lb } 12 \text{ oz}} \\ 7 \text{ lb } 19 \text{ oz} \end{array}$$

7 lb 19 oz = 8 lb 3 oz

25.

$$\begin{array}{r} {\scriptstyle 6} \quad\quad {\scriptstyle 21} \\ 7 \text{ lb } \cancel{5} \text{ oz} \\ \underline{-3 \text{ lb } 8 \text{ oz}} \\ 3 \text{ lb } 13 \text{ oz} \end{array}$$

27. $6\frac{3}{8}\text{ lb} = 6\frac{9}{24}\text{ lb} = 5\frac{33}{24}\text{ lb}$

$$\underline{-2\frac{5}{6}\text{ lb} = 2\frac{20}{24}\text{ lb} = 2\frac{20}{24}\text{ lb}}$$

$$3\frac{13}{24}\text{ lb}$$

29. $5\frac{1}{2}\text{ lb} \times 6 = \frac{11}{2}\text{ lb} \times 6$

$$= \frac{66}{2}\text{ lb}$$

$$= 33\text{ lb}$$

31.
$$2\overline{)3\text{ lb}\quad 8\text{ oz}}\qquad 1\text{ lb } 12\text{ oz}$$

$$\underline{-2\text{ lb}}$$

$$1\text{ lb} = \underline{16\text{ oz}}$$

$$24\text{ oz}$$

$$\underline{-24\text{ oz}}$$

$$0$$

Objective C Exercises

33. Greater than

35. **Strategy** To find the total weight of the iron rods:

• Multiply the number of rods (25) by the weight of each rod (20 oz).

• Convert the number of ounces to pounds.

Solution
$$\begin{array}{r} 25 \\ \times\ 20\text{ oz} \\ \hline 500\text{ oz} \end{array}$$

$$500\ \cancel{\text{oz}} \times \frac{1\text{ lb}}{16\ \cancel{\text{oz}}} = 31\frac{1}{4}\text{ lb}$$

The iron rods weighs $31\frac{1}{4}\text{ lb}$.

37. **Strategy** To find the total weight of the textbooks:

• Multiply the number of textbooks (1200) by the weight of one textbook (9 oz).

• Convert the number of ounces to pounds.

Solution
$$\begin{array}{r} 1200 \\ \times\ 9\text{ oz} \\ \hline 10{,}800\text{ oz} \end{array}$$

$$10{,}800\ \cancel{\text{oz}} \times \frac{1\text{ lb}}{16\ \cancel{\text{oz}}} = 675\text{ lb}$$

The total weight of the textbooks is 675 lb.

39. **Strategy** To find the weight of the case in pounds:

• Find the weight in ounces by multiplying the weight of each can (6 oz) by the number of cans (24).

• Convert the weight in ounces to pounds.

Solution
$$\begin{array}{r} 6\text{ oz} \\ \times\ 24 \\ \hline 144\text{ oz} \end{array}$$

$$144\ \cancel{\text{oz}} \times \frac{1\text{ lb}}{16\ \cancel{\text{oz}}} = 9\text{ lb}$$

The weight of the case of soft drinks is 9 lb.

41. **Strategy** To find how much shampoo is in each container, divide the total weight of the shampoo (5 lb 4 oz) by the number of containers (4).

Solution
$$4\overline{)5\text{ lb}\quad 4\text{ oz}}\qquad 1\text{ lb } 5\text{ oz}$$

$$\underline{-4\text{ lb}}$$

$$1\text{ lb} = \underline{16\text{ oz}}$$

$$20\text{ oz}$$

$$\underline{-20\text{ oz}}$$

$$0$$

Each container holds 1 lb 5 oz of shampoo.

43. **Strategy** To find the cost of mailing the manuscript:

• Convert 2 lb 3 oz to ounces.

• Multiply the number of ounces by the postage rate per ounce ($.44)

Solution 2 lb 3 oz = 35 oz

$$\begin{array}{r} 0.44 \\ \times \quad 35 \\ \hline 15.40 \end{array}$$

The cost of mailing the manuscript is $15.40.

Projects or Group Activities

45. 16 drams = 1 oz

47. 512 drams = 2 lb

Section 8.3

Concept Check

1. Greater than

3a. $\dfrac{1 \text{ pt}}{2 \text{ c}}$

b. $\dfrac{4 \text{ qt}}{1 \text{ gal}}$

Objective A Exercises

5. $48 \text{ fl oz} = 48 \text{ } \cancel{\text{fl oz}} \times \dfrac{1 \text{ c}}{8 \text{ } \cancel{\text{fl oz}}} = 6 \text{ c}$

7. $2\dfrac{1}{2}\text{c} = 2\dfrac{1}{2} \text{ } \cancel{\text{c}} \times \dfrac{8 \text{ fl oz}}{1 \text{ } \cancel{\text{c}}} = 20 \text{ fl oz}$

9. $5 \text{ c} = 5 \text{ } \cancel{\text{c}} \times \dfrac{1 \text{ pt}}{2 \text{ } \cancel{\text{c}}} = 2\dfrac{1}{2} \text{ pt}$

11. $12 \text{ pt} = 12 \text{ } \cancel{\text{pt}} \times \dfrac{1 \text{ qt}}{2 \text{ } \cancel{\text{pt}}} = 6 \text{ qt}$

13. $10 \text{ qt} = 10 \text{ } \cancel{\text{qt}} \times \dfrac{1 \text{ gal}}{4 \text{ } \cancel{\text{qt}}} = 2\dfrac{1}{2} \text{ gal}$

15. $7 \text{ gal} = 7 \text{ } \cancel{\text{gal}} \times \dfrac{4 \text{ } \cancel{\text{qt}}}{1 \text{ } \cancel{\text{gal}}} \times \dfrac{2 \text{ pt}}{1 \text{ } \cancel{\text{qt}}} = 56 \text{ pt}$

17. $17 \text{ c} = 17 \text{ } \cancel{\text{c}} \times \dfrac{1 \text{ } \cancel{\text{pt}}}{2 \text{ } \cancel{\text{c}}} \times \dfrac{1 \text{ qt}}{2 \text{ } \cancel{\text{pt}}} = 4\dfrac{1}{4} \text{ qt}$

Objective B Exercises

19. 4

21. $4\overline{)14}$ 3 gal 2 qt

$$\begin{array}{r} -12 \\ \hline 2 \end{array}$$

14 qt = 3 gal 2qt

23.

$$\begin{array}{r} 3 \text{ gal } 2 \text{ qt} \\ +\ 4 \text{ gal } 3 \text{ qt} \\ \hline 7 \text{ gal } 5 \text{ qt} \end{array} = 8 \text{ gal } 1 \text{ qt}$$

25.

$$\begin{array}{r} 3 \text{ gal } 3 \text{ qt} \\ +\ 1 \text{ gal } 2 \text{ qt} \\ \hline 4 \text{ gal } 5 \text{ qt} \end{array} = 5 \text{ gal } 1 \text{ qt}$$

27.

$$\begin{array}{r} 2 \text{ gal } \quad 5 \text{ qt} \\ \cancel{3 \text{ gal } \quad 1 \text{ qt}} \\ -\ 1 \text{ gal } \quad 2 \text{ qt} \\ \hline 1 \text{ gal } \quad 3 \text{ qt} \end{array}$$

29.

$$\begin{array}{r} 3 \text{ c } 14 \text{ fl oz} \\ \cancel{4 \text{ c }\ 6 \text{ fl oz}} \\ -\ 2 \text{ c } \ 7 \text{ fl oz} \\ \hline 1 \text{ c } 7 \text{ fl oz} \end{array}$$

31.

$$\begin{aligned} 4\frac{1}{2} \text{ gal} - 1\frac{3}{4} \text{ gal} &= 4\frac{2}{4} \text{ gal} - 1\frac{3}{4} \text{ gal} \\ &= 3\frac{6}{4} \text{ gal} - 1\frac{3}{4} \text{ gal} \\ &= 2\frac{3}{4} \text{ gal} \end{aligned}$$

33. $3\dfrac{1}{2}\text{pt} \times 5 = \dfrac{7}{2} \text{ pt} \times 5 = \dfrac{35}{2} \text{ pt} = 17\dfrac{1}{2} \text{ pt}$

35. $3\frac{1}{2}\text{ gal} \div 4 = 3\frac{1}{2}\text{ gal} \times \frac{1}{4}$

$= \frac{7}{2}\text{ gal} \times \frac{1}{4}$

$= \frac{7}{8}\text{ gal}$

Objective C Exercises

37. **Strategy** To find how many gallons of coffee should be prepared:

• Find how many cups of coffee should be prepared by multiplying the number of adults attending (60) by the number of cups each adult will drink (2).

• Convert the number of cups to gallons.

Solution $2\text{ c} \times 60 = 120\text{ c}$

$120\ \cancel{\text{c}} \times \frac{1\ \cancel{\text{pt}}}{2\ \cancel{\text{c}}} \times \frac{1\ \cancel{\text{qt}}}{2\ \cancel{\text{pt}}} \times \frac{1\text{ gal}}{4\ \cancel{\text{qt}}}$

$= \frac{120\text{ gal}}{16}$

$= 7\frac{1}{2}\text{ gal}$

$7\frac{1}{2}\text{ gal}$ of coffee should be prepared.

39. **Strategy** To find the more economical purchase:

• Convert 1 qt to ounces.

• Compare the price per ounce of each brand of tomato juice.

Solution 1 qt

$= 1\ \cancel{\text{qt}} \times \frac{2\ \cancel{\text{pt}}}{1\ \cancel{\text{qt}}} \times \frac{2\ \cancel{\text{c}}}{1\ \cancel{\text{pt}}} \times \frac{8\text{ oz}}{1\ \cancel{\text{c}}}$

$= 32\text{ oz}$

First brand: $32\overline{)1.5900}\ \ 0.0497$

Second brand: $24\overline{)1.250}\ \ 0.052$

$0.0497 < 0.052$

The more economical purchase is 1 qt for \$1.59 (the first brand).

41. **Strategy** To find the number of gallons of oil the farmer used:

• Multiply 5 qt by 7 to find the number of quarts used.

• Convert the number of quarts to gallons.

Solution

$$\begin{array}{r} 5\text{ qt} \\ \times\quad 7 \\ \hline 35\text{ qt of oil} \end{array}$$

$35\text{ qt} = 35\ \cancel{\text{qt}} \times \frac{1\text{ gal}}{4\ \cancel{\text{qt}}}$

$= 8\frac{3}{4}\text{ gal}$

The farmer used $8\frac{3}{4}$ gal of oil.

43. **Strategy** To find the number of gallons of bottled water were donated:

- Multiply the number of bottles donated (7200) by the capacity of each bottle (16.9 fl oz).

- Convert the number of fluid ounces to gallons.

Solution

$7200 \times 16.9 = 121{,}680$

121,680 fl oz

$$= 121{,}680 \text{ fl oz} \times \frac{1 \text{ pt}}{16 \text{ fl oz}} \times \frac{1 \text{ qt}}{2 \text{ pt}} \times \frac{1 \text{ gal}}{4 \text{ qt}}$$

≈ 951 gal

951 gal of water were donated.

45. **Strategy** To find the profit Orlando makes:

- Convert 50 gallons to quarts.
- Multiply the number of quarts by the customer's cost per quart ($9.25) to find the total income.
- Subtract Orlando's cost ($960) from the total income to find the profit.

Solution

$$50 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}} = 200 \text{ qt}$$

$200 \times 9.25 = 1850$

$1850 - 960 = 890$

Orlando's profit was $890.

47. Number of cups of lemonade in the punch

Critical Thinking

49. Students may enjoy exercising the creativity required to answer this question. However, they should note that a standard unit of measurement must be developed first. Related units can then be developed using equivalences that allow for conversion of units.

Projects or Group Activities

51. 80 fluid drams $= 2\frac{1}{2}$ gills

53. 2 qt = 512 fluid drams

Check Your Progress: Chapter 8

1. $7 \text{ ft} = 7 \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}} = 84 \text{ in.}$

2. $28 \text{ in.} = 28 \text{ in.} \times \frac{1 \text{ ft}}{12 \text{ in.}} = \frac{7}{3} \text{ ft} = 2\frac{1}{3} \text{ ft}$

3. $12\text{yd} = 12 \text{ yd} \times \frac{3 \text{ ft}}{1 \text{ yd}} = 36 \text{ ft}$

4. $96 \text{ in.} = 96 \text{ in.} \times \frac{1 \text{ yd}}{36 \text{ in.}} = \frac{8}{3} \text{ yd} = 2\frac{2}{3} \text{ yd}$

5.

$$9240 \text{ ft} = 9240 \text{ ft} \times \frac{1 \text{ mi}}{5280 \text{ ft}} = \frac{7}{4} \text{ mi} = 1\frac{3}{4} \text{ mi}$$

6. $8 \text{ lb} = 8 \text{ lb} \times \frac{16 \text{ oz}}{1 \text{ lb}} = 128 \text{ oz}$

7. $\frac{3}{4} \text{ ton} = \frac{3}{4} \text{ ton} \times \frac{2000 \text{ lb}}{1 \text{ ton}} = 1500 \text{ lb}$

8. $24 \text{ oz} = 24 \text{ oz} \times \frac{1 \text{ lb}}{16 \text{ oz}} = \frac{3}{2} \text{ lb} = 1\frac{1}{2} \text{ lb}$

9. $24 \text{ fl oz} = 24 \text{ fl oz} \times \frac{1 \text{ c}}{8 \text{ fl oz}} = 3 \text{ c}$

10. $14 \text{ qt} = 14 \text{ qt} \times \frac{1 \text{ gal}}{4 \text{ qt}} = \frac{7}{2} \text{ gal} = 3\frac{1}{2} \text{ gal}$

11. $8 \text{ pt} = 8 \text{ pt} \times \frac{1 \text{ qt}}{2 \text{ pt}} = 4 \text{ qt}$

12. 40 c

$$= 40 \text{ c} \times \frac{8 \text{ fl oz}}{1 \text{ c}} \times \frac{1 \text{ pt}}{16 \text{ fl oz}} \times \frac{1 \text{ qt}}{2 \text{ pt}}$$

$= 10$ qt

13. $100 \text{ in.} = 100 \text{ in.} \times \frac{1 \text{ ft}}{12 \text{ in.}}$

$= 8\frac{1}{3} \text{ ft}$

$= 8 \text{ ft} + \frac{1}{3} \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}}$

$= 8 \text{ ft} + 4 \text{ in.}$

14. $7000 \text{ lb} = 7000 \text{ lb} \times \frac{1 \text{ ton}}{2000 \text{ lb}}$

$= 3\frac{1}{2} \text{ tons}$

$= 3 \text{ tons} + \frac{1}{2} \text{ ton} \times \frac{2000 \text{ lb}}{1 \text{ ton}}$

$= 3 \text{ tons} + 1000 \text{ lb}$

15. $15 \text{ qt} = 15 \text{ qt} \times \frac{1 \text{ gal}}{4 \text{ qt}}$

$= 3\frac{3}{4} \text{ gal}$

$= 3 \text{ gal} + \frac{3}{4} \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}}$

$= 3 \text{ gal} + 3 \text{ qt}$

16.
$$\begin{array}{r} 9 \text{ ft } 11 \text{ in.} \\ +\ 5 \text{ ft } \ 6 \text{ in.} \\ \hline 14 \text{ ft } 17 \text{ in.} = 15 \text{ ft } 5 \text{ in.} \end{array}$$

17.
$$\begin{array}{r} 7 \text{ lb } 1 \text{ oz} = 6 \text{ lb } 17 \text{ oz} \\ -\ 2 \text{ lb } 4 \text{ oz} = 2 \text{ lb } \ 4 \text{ oz} \\ \hline 4 \text{ lb } 13 \text{ oz} \end{array}$$

18.
$$\begin{array}{r} 3 \text{ gal } 2 \text{ qt} \\ \times \qquad 4 \\ \hline 12 \text{ gal } 8 \text{ qt} = 14 \text{ gal} \end{array}$$

19. **Strategy** To find the length of each piece of rope, divide the total length $6\frac{1}{2}$ ft by 3.

Solution

$6\frac{1}{2} \text{ ft} \div 3$

$= \frac{13}{2} \text{ ft} \times \frac{1}{3}$

$= \frac{13}{6} \text{ ft}$

$= 2\frac{1}{6} \text{ ft}$

$= 2 \text{ ft} + \frac{1}{6} \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}}$

$= 2 \text{ ft } 2 \text{ in.}$

Each piece of rope is 2 ft 2 in. long.

20. **Strategy** To find the number of pounds of lasagna:

- Multiply the number of orders (20) by the weight of each order (10 oz).
- Convert from ounces to pounds.

Solution $20 \times 10 = 200$

$200 \text{ oz} = 200 \text{ oz} \times \frac{1 \text{ lb}}{16 \text{ oz}}$

$= 12\frac{1}{2} \text{ lb}$

The chef should prepare $12\frac{1}{2}$ lb of lasagna.

21. **Strategy** To find the number of gallons, convert fluid ounces to gallons.

Solution

3200 fl oz

$= 3200 \text{ fl oz} \times \frac{1 \text{ pt}}{16 \text{ fl oz}} \times \frac{1 \text{ qt}}{2 \text{ pt}} \times \frac{1 \text{ gal}}{4 \text{ qt}}$

$= 25 \text{ gal}$

25 gallons of juice are required.

Section 8.4

Concept Check

1. Greater than

3a. $\dfrac{60 \text{ s}}{1 \text{ min}}$

b. $\dfrac{1 \text{ day}}{24 \text{ h}}$

Objective A Exercises

5. $12 \text{ weeks} = 12 \text{ weeks} \times \dfrac{7 \text{ days}}{1 \text{ week}} = 84 \text{ days}$

7. $114 \text{ h} = 114 \text{ h} \times \dfrac{1 \text{ day}}{24 \text{ h}} = 4\dfrac{3}{4} \text{ days}$

9. $7\dfrac{3}{4} \text{ h} = 7\dfrac{3}{4} \text{ h} \times \dfrac{60 \text{ min}}{1 \text{ h}} = 465 \text{ min}$

11. $750 \text{ s} = 750 \text{ s} \times \dfrac{1 \text{ min}}{60 \text{ s}} = 12\dfrac{1}{2} \text{min}$

13. $15{,}300 \text{ s} = 15{,}300 \text{ s} \times \dfrac{1 \text{ min}}{60 \text{ s}} \times \dfrac{1 \text{ h}}{60 \text{ min}}$

$= 4\dfrac{1}{4} \text{ h}$

15. $5\dfrac{3}{4} \text{ h} = 5\dfrac{3}{4} \text{ h} \times \dfrac{60 \text{ min}}{1 \text{ h}} \times \dfrac{60 \text{ s}}{1 \text{ min}} = 20{,}700 \text{ s}$

17. $6840 \text{ min} = 6840 \text{ min} \times \dfrac{1 \text{ h}}{60 \text{ min}} \times \dfrac{1 \text{ day}}{24 \text{ h}}$

$= 4\dfrac{3}{4} \text{ days}$

19. $6\dfrac{1}{4} \text{ days} = 6\dfrac{1}{4} \text{ days} \times \dfrac{24 \text{ h}}{1 \text{ day}} \times \dfrac{60 \text{ min}}{1 \text{ h}}$

$= 9000 \text{ min}$

21. $588 \text{ h} = 588 \text{ h} \times \dfrac{1 \text{ day}}{24 \text{ h}} \times \dfrac{1 \text{ week}}{7 \text{ days}}$

$= 3\dfrac{1}{2} \text{ weeks}$

23. $5\dfrac{1}{2} \text{ weeks} = 5\dfrac{1}{2} \text{ weeks} \times \dfrac{7 \text{ days}}{1 \text{ week}} \times \dfrac{24 \text{ h}}{1 \text{ day}}$

$= 924 \text{ h}$

25. $20{,}160 \text{ min}$

$= 20{,}160 \text{ min} \times \dfrac{1 \text{ h}}{60 \text{ min}} \times \dfrac{1 \text{ day}}{24 \text{ h}} \times \dfrac{1 \text{ week}}{7 \text{ days}}$

$= 2 \text{ weeks}$

27. 3 weeks

$= 3 \text{ weeks} \times \dfrac{7 \text{ days}}{1 \text{ week}} \times \dfrac{24 \text{ h}}{1 \text{ day}} \times \dfrac{60 \text{ min}}{1 \text{ h}}$

$= 30{,}240 \text{ min}$

Critical Thinking

29. No, the year 2022 is not divisible by 4.

Projects or Group Activities

31. A solar year is the time required for the earth to make one complete revolution around the sun. A sidereal year is the time required for the earth to make one complete revolution around the sun, relative to the fixed stars, which is a slightly longer period of time than a solar year.

Section 8.5

Concept Check

1. Greater than

Objective A Exercises

3. $25 \text{ Btu} = 25 \text{ Btu} \times \dfrac{778 \text{ ft-lb}}{1 \text{ Btu}}$

$= 19{,}450 \text{ ft-lb}$

5. $25{,}000 \text{ Btu} = 25{,}000 \text{ Btu} \times \dfrac{778 \text{ ft-lb}}{1 \text{ Btu}}$

$= 19{,}450{,}000 \text{ ft-lb}$

7. Energy = 150 lb × 10 ft
= 1500 ft-lb

9. Energy = 3300 lb × 9 ft
= 29,700 ft-lb

11. 3 tons = 6000 lb
Energy = 6000 lb × 5 ft
= 30,000 ft-lb

13. 850 × 3 lb = 2550 lb
Energy = 2550 lb × 10 ft = 25,500 ft-lb

15. $45{,}000 \text{ Btu} = 45{,}000 \text{ } \cancel{\text{Btu}} \times \dfrac{778 \text{ ft-lb}}{1 \text{ } \cancel{\text{Btu}}}$
$= 35{,}010{,}000 \text{ ft-lb}$

17. $12{,}000 \text{ Btu} = 12{,}000 \text{ } \cancel{\text{Btu}} \times \dfrac{778 \text{ ft-lb}}{1 \text{ } \cancel{\text{Btu}}}$
$= 9{,}336{,}000 \text{ ft-lb}$

19. Less than

21. $\dfrac{1100}{550} = 2 \text{ hp}$

23. $\dfrac{4400}{550} = 8 \text{ hp}$

25. $9 \times 550 \dfrac{\text{ft-lb}}{\text{s}} = 4950 \dfrac{\text{ft-lb}}{\text{s}}$

27. $7 \times 550 \dfrac{\text{ft-lb}}{\text{s}} = 3850 \dfrac{\text{ft-lb}}{\text{s}}$

29. $\text{Power} = \dfrac{125 \text{ lb} \times 12 \text{ ft}}{3 \text{ s}}$
$= 500 \dfrac{\text{ft-lb}}{\text{s}}$

31. $\text{Power} = \dfrac{1200 \text{ lb} \times 18 \text{ ft}}{30 \text{ s}} = 720 \dfrac{\text{ft-lb}}{\text{s}}$

33. $\dfrac{16{,}500}{550} = 30 \text{ hp}$

Critical Thinking

35.a $50 \text{ hp} = 50 \text{ hp} \times \dfrac{0.707 \dfrac{\text{Btu}}{\text{s}}}{1 \text{ hp}} = 35.35 \dfrac{\text{Btu}}{\text{s}}$

b. $200 \dfrac{\text{Btu}}{\text{s}} = 200 \dfrac{\text{Btu}}{\text{s}} \times \dfrac{1.415 \text{ hp}}{1 \dfrac{\text{Btu}}{\text{s}}} = 283 \text{ hp}$

c. $1500 \dfrac{\text{Btu}}{\text{s}} = 1500 \dfrac{\text{Btu}}{\text{s}} \times \dfrac{1.415 \text{ hp}}{1 \dfrac{\text{Btu}}{\text{s}}}$
$= 2122.5 \text{ hp}$

d. $300 \text{ hp} = 300 \text{ hp} \times \dfrac{0.707 \dfrac{\text{Btu}}{\text{s}}}{1 \text{ hp}}$
$= 212.1 \dfrac{\text{Btu}}{\text{s}}$

Chapter 8 Review Exercises

1. $4 \text{ ft} = 4 \text{ } \cancel{\text{ft}} \times \dfrac{12 \text{ in.}}{1 \text{ } \cancel{\text{ft}}} = 48 \text{ in.}$

2.
$$\begin{array}{r} 2 \text{ ft } 6 \text{ in.} \\ 3\overline{)7 \text{ ft } 6 \text{ in.}} \\ \underline{-6 \text{ ft}} \\ 1 \text{ ft} = \underline{12 \text{ in.}} \\ 18 \text{ in.} \\ \underline{-18 \text{ in.}} \\ 0 \end{array}$$

3. Energy = 200 lb × 8 ft = 1600 ft-lb

4. $2\dfrac{1}{2} \text{ pt} = 2\dfrac{1}{2} \text{ } \cancel{\text{pt}} \times \dfrac{2 \text{ } \cancel{\text{c}}}{1 \text{ } \cancel{\text{pt}}} \times \dfrac{8 \text{ fl oz}}{1 \text{ } \cancel{\text{c}}}$
$= 2\dfrac{1}{2} \times 16 \text{ fl oz}$
$= \dfrac{5}{2} \times 16 \text{ fl oz}$
$= 40 \text{ fl oz}$

5. $14 \text{ ft} = 14 \text{ } \cancel{\text{ft}} \times \dfrac{1 \text{ yd}}{3 \text{ } \cancel{\text{ft}}}$

$= \dfrac{14}{3} \text{ yd}$

$= 4\dfrac{2}{3} \text{ oz}$

6. $2400 \text{ lb} = 2400 \text{ } \cancel{\text{lb}} \times \dfrac{1 \text{ ton}}{2000 \text{ } \cancel{\text{lb}}}$

$= \dfrac{2400}{2000} \text{ tons} = 1\dfrac{1}{5} \text{ tons}$

7. $3\overline{)\begin{array}{ll} 2 \text{ lb} & 7 \text{ oz} \\ 7 \text{ lb} & 5 \text{ oz} \end{array}}$

$\underline{-6 \text{ lb}}$

$1 \text{ lb} = \underline{16 \text{ oz}}$

21 oz

$\underline{-21 \text{ oz}}$

0

8. $3\dfrac{3}{8} \text{ lb} = 3\dfrac{3}{8} \text{ } \cancel{\text{lb}} \times \dfrac{16 \text{ oz}}{1 \text{ } \cancel{\text{lb}}}$

$= 3\dfrac{3}{8} \times 16 \text{ oz}$

$= \dfrac{27}{8} \times 16 \text{ oz} = 54 \text{ oz}$

9. $\begin{array}{r} 3 \text{ ft} \quad 9 \text{ in.} \\ +\ 5 \text{ ft} \quad 6 \text{ in.} \\ \hline 8 \text{ ft} \quad 15 \text{ in.} = 9 \text{ ft } 3 \text{ in.} \end{array}$

10. $\begin{array}{r} \overset{2}{\cancel{3}} \text{ tons } \overset{2500}{\cancel{500}} \text{ lb} \\ -1 \text{ ton} \quad 1500 \text{ lb} \\ \hline 1 \text{ ton} \quad 1000 \text{ lb} \end{array}$

11. $\begin{array}{r} 4 \text{ c} \quad 7 \text{ fl oz} \\ +2 \text{ c} \quad 3 \text{ fl oz} \\ \hline 6 \text{ c } 10 \text{ fl oz} = 7 \text{ c } 2 \text{ fl oz} \end{array}$

12. $\begin{array}{r} \overset{4}{\cancel{5}} \text{ yd } \overset{4}{\cancel{1}} \text{ ft} \\ -\ 3 \text{ yd} \quad 2 \text{ ft} \\ \hline 1 \text{ yd} \quad 2 \text{ ft} \end{array}$

13. $12 \text{ } \cancel{\text{c}} \times \dfrac{1 \text{ } \cancel{\text{pt}}}{2 \text{ } \cancel{\text{c}}} \times \dfrac{1 \text{ qt}}{2 \text{ } \cancel{\text{pt}}} = \dfrac{12}{4} \text{ qt} = 3 \text{ qt}$

14. $375 \text{ min} \times \dfrac{1 \text{ h}}{60 \text{ min}} = 6\dfrac{1}{4} \text{ h}$

15. $2.5 \text{ hp} \times 550 \ \dfrac{\text{ft-lb}}{\text{s}} = 1375 \ \dfrac{\text{ft-lb}}{\text{s}}$

16. $\dfrac{3850}{550} = 7 \text{ hp}$

17. $50 \text{ Btu} = 50 \text{ } \cancel{\text{Btu}} \times \dfrac{778 \text{ ft-lb}}{1 \text{ } \cancel{\text{Btu}}} = 38{,}900 \text{ ft-lb}$

18. $\begin{array}{r} 5 \text{ lb } 8 \text{ oz} \\ \times \qquad 8 \\ \hline 40 \text{ lb } 64 \text{ oz} = 44 \text{ lb} \end{array}$

19. **Strategy** To find the length of the remaining piece of board, subtract the length of the piece cut (6 ft 11 in.) from the total length (10 ft 5 in.).

Solution $\begin{array}{r} \overset{9}{\cancel{10}} \text{ ft } \overset{17}{\cancel{5}} \text{ in.} \\ -\ 6 \text{ ft } 11 \text{ in.} \\ \hline 3 \text{ ft} \quad 6 \text{ in.} \end{array}$

The length of the remaining piece is 3 ft 6 in.

20. **Strategy** To find the cost of mailing the book:

- Find the weight of the book in ounces.
- Multiply the weight of the book in ounces by the price per ounce for postage ($0.29).

Solution $2 \text{ lb } 3 \text{ oz} = 35 \text{ oz}$

$\begin{array}{r} 0.29 \\ \times \quad 35 \\ \hline 10.15 \end{array}$

The cost of mailing the book is $10.15.

21. **Strategy** To find the number of quarts in a case:

• Find the number of ounces in a case by multiplying the number of ounces in a can (18 fl oz) by the number of cans in a case (24).

• Convert the number of ounces to quarts.

Solution

$$\begin{array}{r} 18 \text{ fl oz} \\ \times \quad 24 \\ \hline 432 \text{ fl oz} \end{array}$$

$$432 \text{ fl oz} \times \frac{1 \text{ c}}{8 \text{ fl oz}} \times \frac{1 \text{ pt}}{2 \text{ c}} \times \frac{1 \text{ qt}}{2 \text{ pt}}$$

$$= \frac{432}{32} \text{ qt} = 13\frac{1}{2} \text{ qt}$$

There are $13\frac{1}{2}$ qt in a case.

22. **Strategy** To find how many gallons of milk were sold:

• Find the number of cups sold by multiplying the number of cartons (256) by the number of cups per carton (1).

• Convert the number of cups to gallons.

Solution $256 \text{ cartons} \times 1 \text{ c} = 256 \text{ c}$

$$256 \text{ c} = 256 \text{ c} \times \frac{1 \text{ pt}}{2 \text{ c}} \times \frac{1 \text{ qt}}{2 \text{ pt}} \times \frac{1 \text{ gal}}{4 \text{ qt}}$$

$$= \frac{256}{16} \text{ gal} = 16 \text{ gal}$$

16 gal of milk were sold that day.

23. $$35{,}0000 \text{ Btu} = 35{,}000 \text{ Btu} \times \frac{778 \text{ ft-lb}}{1 \text{ Btu}}$$

$$= 27{,}230{,}000 \text{ ft-lb}$$

24. $$\text{Power} = \frac{800 \text{ lb} \times 15 \text{ ft}}{25 \text{ s}} = 480 \frac{\text{ft-lb}}{\text{s}}$$

Chapter 8 Test

1. $$2\frac{1}{2} \text{ ft} = 2\frac{1}{2} \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}} = 2\frac{1}{2} \times 12 \text{ in.}$$

$$= \frac{5}{2} \times 12 \text{ in.}$$

$$= 30 \text{ in.}$$

2.

$$\begin{array}{r} 4 \text{ ft } 2 \text{ in.} \\ -1 \text{ ft } 9 \text{ in.} \\ \hline 2 \text{ ft } 5 \text{ in.} \end{array}$$

3. $$1\frac{3}{4} \text{ gal} \times 7 = \frac{7}{4} \text{ gal} \times 7 = \frac{49}{4} \text{ gal}$$

$$= 12\frac{1}{4} \text{ gal}$$

4.

$$\begin{array}{r} 5 \text{ gal } 2 \text{ qt} \\ +\ 2 \text{ gal } 3 \text{ qt} \\ \hline 7 \text{ gal } 5 \text{ qt} = 8 \text{ gal } 1 \text{ qt} \end{array}$$

5. $$2\frac{7}{8} \text{ lb} = 2\frac{7}{8} \text{ lb} \times \frac{16 \text{ oz}}{1 \text{ lb}}$$

$$= 2\frac{7}{8} \times 16 \text{ oz} = \frac{23}{8} \times 16 \text{ oz}$$

$$= 46 \text{ oz}$$

6.

$$\begin{array}{r} 2 \text{ lb } 8 \text{ oz} \\ 16\overline{)40} \\ \underline{-32} \\ 8 \end{array}$$

$40 \text{ oz} = 2 \text{ lb } 8 \text{ oz}$

7.

$$\begin{array}{r} 9 \text{ lb } 6 \text{ oz} \\ +\ 7 \text{ lb } 11 \text{ oz} \\ \hline 16 \text{ lb } 17 \text{ oz} = 17 \text{ lb } 1 \text{ oz} \end{array}$$

8.
$$\begin{array}{r} 1\text{ lb}\quad 11\text{ oz} \\ 4\overline{)\,6\text{ lb}\quad 12\text{ oz}} \\ \underline{-4\text{ lb}} \\ 2\text{ lb} = \underline{32\text{ oz}} \\ 44\text{ oz} \\ \underline{-44\text{ oz}} \\ 0 \end{array}$$

9. $756\text{ h} = 756\ \cancel{\text{h}} \times \dfrac{1\ \cancel{\text{day}}}{24\ \cancel{\text{h}}} \times \dfrac{1\text{ week}}{7\ \cancel{\text{days}}}$

$= 4\dfrac{1}{2}\text{ weeks}$

10. $3\dfrac{1}{4}\text{ days} = 3\dfrac{1}{4}\ \cancel{\text{days}} \times \dfrac{24\ \cancel{\text{h}}}{1\ \cancel{\text{day}}} \times \dfrac{60\text{ min}}{1\ \cancel{\text{h}}}$

$= 4680\text{ min}$

11. $13\text{ qt} = 13\ \cancel{\text{qt}} \times \dfrac{1\text{ gal}}{4\ \cancel{\text{qt}}} = \dfrac{13}{4}\text{ gal} = 3\dfrac{1}{4}\text{ gal}$

12. $3\dfrac{1}{2}\text{ gal} = 3\dfrac{1}{2}\ \cancel{\text{gal}} \times \dfrac{4\ \cancel{\text{qt}}}{1\ \cancel{\text{gal}}} \times \dfrac{2\text{ pt}}{1\ \cancel{\text{qt}}}$

$= 3\dfrac{1}{2} \times 8\text{ pt} = 28\text{ pt}$

13. **Strategy** To find the total weight of the workbooks in pounds:

- Find the total weight of the workbooks in ounces by multiplying the number of workbooks (1000) by the weight per workbook (12 oz).
- Convert the weight in ounces to pounds.

Solution $1000 \times 12\text{ oz} = 12{,}000\text{ oz}$

$12{,}000\text{ oz} = 12{,}000\ \cancel{\text{oz}} \times \dfrac{1\text{ lb}}{16\ \cancel{\text{oz}}}$

$= 750\text{ lb}$

The total weight of the workbooks is 750 lb.

14. **Strategy** To find the amount received for recycling the cans:

- Find the weight in ounces of the cans by solving a proportion.
- Convert the weight in ounces to pounds.
- Multiply the weight in pounds by the price paid per pound.

Solution
$$\frac{4\text{ cans}}{3\text{ oz}} = \frac{800\text{ cans}}{n}$$
$$4 \times n = 3 \times 800$$
$$4 \times n = 2400$$
$$n = 2400 \div 4 = 600$$

The cans weigh 600 oz. 600 oz.

$600\text{ oz} = 600\ \cancel{\text{oz}} \times \dfrac{1\text{ lb}}{16\ \cancel{\text{oz}}} = 37.5\text{ lb}$

$37.5 \times 0.75 = 28.13$

The amount the class received for recycling was \$28.13.

15. **Strategy** To find the length of each equal piece, divide the total length $6\dfrac{2}{3}\text{ ft}$ by the number of pieces (5).

Solution
$$6\frac{2}{3}\text{ ft} \div 5 = \frac{20}{3}\text{ ft} \div 5$$
$$= \frac{20}{3}\text{ ft} \times \frac{1}{5}$$
$$= \frac{4}{3}\text{ ft} = 1\frac{1}{3}\text{ ft}$$

16. **Strategy** To find the length of the wall in feet:

- Find the length of the wall in inches by multiplying the

length of one brick (8 in.) by the number of bricks (72).

• Convert the length in inches to feet.

Solution

$$\begin{array}{r} 8 \text{ in.} \\ \times\ 72 \\ \hline 576 \text{ in.} \end{array}$$

$$576 \text{ in.} = 576 \text{ } \cancel{\text{in.}} \times \frac{1 \text{ ft}}{12 \text{ } \cancel{\text{in.}}}$$

$$= 48 \text{ ft}$$

The wall is 48 ft long.

17. Strategy To find the number of cups of grapefruit juice in a case:

• Find the number of ounces of juice in a case by multiplying the number of cans in a case (24) by the number of ounces in a can (20).

• Convert the number of ounces to cups.

Solution $24 \times 20 \text{ oz} = 480 \text{ oz}$

$$480 \text{ oz} = 480 \text{ } \cancel{\text{oz}} \times \frac{1 \text{ c}}{8 \text{ } \cancel{\text{oz}}} = 60 \text{ c}$$

There are 60 c in a case.

18. Strategy To find the profit:

• Convert 40 gal to quarts.

• To find the total income for the sale of the oil, multiply the number of quarts by the sale price per quart ($9.35).

• To find the profit, subtract the price the mechanic pays for the oil ($810) from the total income.

Solution

$$40 \text{ gal} = 40 \text{ } \cancel{\text{gal}} \times \frac{4 \text{ qt}}{1 \text{ } \cancel{\text{gal}}}$$

$$= 160 \text{ qt}$$

$160 \times 9.35 = 1496$ total income

$1496 - 810 = 686$

Nick's profit is $686.

19. $\text{Energy} = 250 \text{ lb} \times 15 \text{ ft} = 3750 \text{ ft-lb}$

20. $40{,}000 \text{ Btu} = 40{,}000 \text{ } \cancel{\text{Btu}} \times \dfrac{778 \text{ ft-lb}}{1 \text{ } \cancel{\text{Btu}}}$

$$= 31{,}120{,}000 \text{ ft-lb}$$

21. $\text{Power} = \dfrac{200 \text{ lb} \times 20 \text{ ft}}{25 \text{ s}} = 160 \dfrac{\text{ft-lb}}{\text{s}}$

22. $\dfrac{2200}{550} = 4 \text{ hp}$

Cumulative Review Exercises

1.

	2	3	5
9 =		(3 · 3)	
12 =	(2 · 2)	3	
15 =		3	(5)

$\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 180$

2.

$$\begin{array}{r} 5\frac{3}{8} \\ 8\overline{)43} \\ \underline{-40} \\ 3 \end{array}$$

$\dfrac{43}{8} = 5\dfrac{3}{8}$

3.

$$\begin{array}{r} 5\frac{7}{8} = 5\frac{21}{24} \\ \underline{-2\frac{7}{12} = 2\frac{14}{24}} \\ 3\frac{7}{24} \end{array}$$

4. $5\dfrac{1}{3} \div 2\dfrac{2}{3} = \dfrac{16}{3} \div \dfrac{8}{3} = \dfrac{16}{3} \times \dfrac{3}{8} = 2$

5.

$$\frac{5}{8} \div \left(\frac{3}{8} - \frac{1}{4}\right) - \frac{5}{8}$$
$$= \frac{5}{8} \div \left(\frac{3}{8} - \frac{2}{8}\right) - \frac{5}{8}$$
$$= \frac{5}{8} \div \frac{1}{8} - \frac{5}{8}$$
$$= \frac{5}{8} \times \frac{8}{1} - \frac{5}{8}$$
$$= 5 - \frac{5}{8}$$
$$= 4\frac{8}{8} - \frac{5}{8} = 4\frac{3}{8}$$

6.

2.0972 ← Given place value
7 > 5

2.10

7.

$$\begin{array}{r} 0.0792 \\ \times \quad 0.49 \\ \hline 7128 \\ 3168 \\ \hline 0.038808 \end{array}$$

8.

$$\frac{n}{12} = \frac{44}{60}$$
$$n \times 60 = 12 \times 44$$
$$n \times 60 = 528$$
$$n = 528 \div 60 = 8.8$$

9.

$$2\frac{1}{2}\% \times 50 = n$$
$$0.025 \times 50 = n$$
$$1.25 = n$$

10.

$$42\% \times n = 18$$
$$0.42 \times n = 18$$
$$n = 18 \div 0.42$$
$$n \approx 42.86$$

11. $\$37.08 \div 7.2 \text{ lb} = \$5.15/\text{lb}$

12.

$$\begin{array}{r} 3\frac{2}{5} \text{ in.} = 3\frac{6}{15} \text{ in.} \\ +5\frac{1}{3} \text{ in.} = 5\frac{5}{15} \text{ in.} \\ \hline 8\frac{11}{15} \text{ in.} \end{array}$$

13.

$$16\overline{)24} \quad \begin{array}{l} 1 \text{ lb } 8 \text{ oz} \\ -16 \\ \hline 8 \end{array}$$

24 oz = 1 lb 8 oz

14.

$$\begin{array}{r} 3 \text{ lb } 8 \text{ oz} \\ \times \quad 9 \\ \hline 27 \text{ lb } 72 \text{ oz} = 31 \text{ lb } 8 \text{ oz} \end{array}$$

15.

$$\begin{array}{r} 4\frac{1}{3} \text{ qt} = 4\frac{2}{6} \text{ qt} = 3\frac{8}{6} \text{ qt} \\ -1\frac{5}{6} \text{ qt} = 1\frac{5}{6} \text{ qt} = 1\frac{5}{6} \text{ qt} \\ \hline 2\frac{3}{6} \text{ qt} = 2\frac{1}{2} \text{ qt} \end{array}$$

16.

$$\begin{array}{r} \cancel{4}^{3} \text{ lb } \cancel{6}^{22} \text{ oz} \\ -2 \text{ lb } 10 \text{ oz} \\ \hline 1 \text{ lb } 12 \text{ oz} \end{array}$$

17. **Strategy** To find the dividend, solve a proportion.

Solution

$$\frac{\$56}{40 \text{ shares}} = \frac{n}{200 \text{ shares}}$$
$$56 \times 200 = 40 \times n$$
$$11{,}200 = 40 \times n$$
$$11{,}200 \div 40 = n$$
$$280 = n$$

The dividend would be $280.

18. **Strategy** To find Anna's checking balance, subtract the amounts of the checks and add the deposit.

Solution

$$\begin{array}{r} 578.56 \\ -216.98 \\ \hline 361.58 \\ -\ 34.12 \\ \hline 327.46 \\ +315.33 \\ \hline 642.79 \end{array}$$

Anna's balance is $642.79.

19. Strategy To find the executive's total monthly income:

- Find the amount of sales over $25,000 by subtracting $25,000 from the total sales ($140,000).
- Find the amount of the commission by solving the basic percent equation for amount. The base is the amount of sales over $25,000 and the percent is 2%.
- Add the amount of commission to the salary ($1800).

Solution

$$140{,}000 - 25{,}000 = 115{,}000$$
$$\text{Percent} \times \text{base} = \text{amount}$$
$$2\% \times 115{,}000 = n$$
$$0.02 \times 115{,}000 = n$$
$$2300 = n$$
$$2300 + 1800 = 4100$$

The executive's monthly income is $4100.

20. Strategy To find the number of miles the driver must drive in one hour, divide the hourly wage ($16.00) by the amount earned per mile ($.46).

Solution

$$\begin{array}{r} 34.7 \approx 35 \\ .46\overline{)16.00.0} \\ -138 \\ \hline 220 \\ -184 \\ \hline 360 \\ -322 \\ \hline 38 \end{array}$$

The driver must drive 35 miles in one hour to earn $16.00 per hour.

21. Strategy To find the percent:

- Find the total number of students who took the final exam by reading the histogram and adding the frequencies.
- Find the number of students who received a score between 80% and 90% by reading the histogram.
- Solve the basic percent equation for percent. The base is the total number of students who took the exam and the amount is the number of students with scores between 80% and 90%.

Solution

$$\begin{aligned}
\text{Score}: 40-50: &\quad 2 \text{ students}\\
50-60: &\quad 1 \text{ students}\\
60-70: &\quad 5 \text{ students}\\
70-80: &\quad 7 \text{ students}\\
80-90: &\quad 4 \text{ students}\\
90-100: &\quad 3 \text{ students}\\
\text{total num of students}: &\quad 22
\end{aligned}$$

$$\begin{aligned}
\text{Percent} \times \text{base} &= \text{amount}\\
n \times 22 &= 4\\
n &= 4 \div 22\\
&\approx 0.18 = 18\%
\end{aligned}$$

The percent is 18%.

22. **Strategy** To find the selling price:

• Find the amount of the markup by solving the basic percent equation for amount. The base is \$220 and the percent is 40%.

• Add the markup to the cost (\$220).

Solution

$$\begin{aligned}
\text{Percent} \times \text{base} &= \text{amount}\\
40\% \times 220 &= n\\
0.40 \times 220 &= n\\
88 &= n\\
220 + 88 &= 308
\end{aligned}$$

The selling price of a compact disc player is \$308.

23. **Strategy** To find the interest paid, multiply the principal (\$200,000) by the annual interest rate (6%) by the time (8 months) in years.

Solution

$$200{,}000 \times 0.06 \times \frac{8}{12} = 8000$$

The interest paid on the loan is \$8000.

24. **Strategy** To find how much each student received:

• Convert 1 lb 3 oz to ounces.

• Find the total value of the gold by multiplying the number of ounces by the price per ounce (\$200).

• Divide the total value by the number of students (6).

Solution

$$\begin{aligned}
&1 \text{ lb } 3 \text{ oz} = 19 \text{ oz}\\
&19 \times 800 = 15{,}200\\
&15{,}200 \div 6 \approx 2533
\end{aligned}$$

Each student received \$2533.

25. **Strategy** To find the cost of mailing the books:

• Find the total weight of the books by adding the 4 weights (1 lb 3 oz, 13 oz, 1 lb 8 oz, and 1 lb).

• Convert the total weight to ounces.

• Find the cost by multiplying the total number of ounces by the price per ounce (\$.28).

Solution

$$\begin{aligned}
&1 \text{ lb } 3 \text{ oz}\\
&\quad 13 \text{ oz}\\
&1 \text{ lb } 8 \text{ oz}\\
+\;&\quad 1 \text{ lb}\\
\hline
&3 \text{ lb } 24 \text{ oz} = 72 \text{ oz}
\end{aligned}$$

$$\begin{aligned}
&0.28\\
\times\;&\quad 72\\
\hline
&20.16
\end{aligned}$$

The cost of mailing the books is \$20.16.

26. **Strategy** To find the better buy:

- Find the unit price for each brand.
- Compare unit prices.

Solution \$.79 for 8 oz \$2.98 for 36 oz

$\frac{0.79}{8} = 0.09875$ $\frac{2.98}{36} \approx 0.08278$ The better buy is 36 oz for \$2.98.

$0.08278 < 0.09875$

27. **Strategy** To calculate the probability:

- Count the number of possible outcomes.
- Count the number of favorable outcomes.
- Use the probability formula.

Solution There are 36 possible outcomes.

There are 4 favorable outcomes:

(3, 6), (4, 5), (5, 4), (6, 3).

$$\text{Probability} = \frac{4}{36} = \frac{1}{9}$$

The probability is $\frac{1}{9}$ that the sum of the dots on the two dice is 9.

28. $\text{Energy} = 400 \text{ lb} \times 8 \text{ ft} = 3200 \text{ ft-lb}$

29. $\text{Power} = \frac{600 \text{ lb} \times 8 \text{ ft}}{12 \text{ s}} = 400 \frac{\text{ft-lb}}{\text{s}}$

Chapter 9: The Metric System of Measurement

Prep Test

1. $3.732 \times 10{,}000 = 37{,}320$

2. $65.9 \times 10^4 = 659{,}000$

3. $41.07 \div 1000 = 0.04107$

4. $28{,}496 \div 10^3 = 28{,}496 \div 1000 = 28.496$

5. $6 - 0.875 = 5.125$

6. $5 + 0.96 = 5.96$

7. $3.25 \times 0.04 = 0.13$

8. $35 \times \dfrac{1.61}{1} = 35 \times 1.61 = 56.35$

9. $1.67 \times \dfrac{1}{3.34} = 1.67 \div 3.34$

$$3.34\overline{)1.67.0}\quad 0.5$$

10. $4\dfrac{1}{2} \times 150 = \dfrac{9}{2} \times \dfrac{150}{1}$

$$= \frac{3 \cdot 3 \cdot \overset{1}{\cancel{2}} \cdot 3 \cdot 5 \cdot 5}{\underset{1}{\cancel{2}}} = 675$$

Section 9.1

Concept Check

1a. Left

b. Right

Objective A Exercises

3. 42 cm = 420 mm

5. 81 mm = 8.1 cm

7. 6804 m = 6.804 km

9. 2.109 km = 2109 m

11. 432 cm = 0.432 dam

13. 0.88 m = 88 cm

15. 7038 m = 70.38 hm

17. 3.5 km = 3500 m

19. 260 cm = 2.60 m

21. 1.685 m = 16.85 dm

23. 14.8 cm = 148 mm

25. 62 m 7 cm = 62 m + 0.07 m = 62.07 m

27. 31 cm 9 mm = 31 cm + 0.9 cm = 31.9 cm

29. 8 km 75m = 8 km + 0.075 km = 8.075 km

31. m

Objective B Exercises

33. **Strategy** To find how many shelves can be cut:
- Convert the length of each shelf (240 cm) to meters.
- Divide the total length (7.20 m) by the length, in meters, of each shelf.

Solution 240 cm = 2.40 m

$$2.40\overline{)7.20}\quad 3$$

The remainder is 0. No length is remaining.

Three shelves can be cut, with no length remaining.

35. **Strategy** To find the total length, convert 1.21m to centimeters and then add the given dimensions.

Solution 1.21 m = 121 cm

$$\begin{array}{r} 42\text{ cm} \\ 18\text{ cm} \\ +\,121\text{ cm} \\ \hline 181\text{ cm} \end{array}$$

The total length is 181 cm.

37. Strategy To find the distance between the rivets, convert 3.4 m to centimeters and then divide the total length of the plate by the number of spaces between the rivets (19).

Solution 3.4 m = 340 cm

$$19\overline{)340} \approx 17.89 \approx 17.9$$

The distance between the rivets is 17.9 cm.

39. Strategy To find the average number of meters covered in each "stage":

- Convert the total distance to meters.
- Divide the length in meters by the number of stages.

Solution 3473 km = 3,473,000 m

$$\begin{array}{r} 173{,}650 \\ 20\overline{)3{,}473{,}000} \\ -20 \\ \hline 147 \\ -140 \\ \hline 73 \\ -60 \\ \hline 130 \\ -120 \\ \hline 100 \\ -100 \\ \hline 0 \end{array}$$

Each stage is an average of 173,650 m long.

41. Strategy To find the time for light to travel to Earth from the sun:

• Convert the distance light travels in 1 s (300,000,000 m) to kilometers.

• Divide the distance from the sun to Earth (150,000,000 km) by the distance light travels in 1 s.

Solution 300,000,000 m = 300,000 km

150,000,000 km ÷ 300,000 km/s = 500 s

It takes 500 s for light to travel from the sun to Earth.

43. Strategy To find the distance that light travels in 1 day:

• Find the number of seconds in 1 day.

• Multiply the distance that light travels in 1 s (300,000 km) by the number of seconds in 1 day.

Solution

$$1 \text{ day} = 1 \cancel{\text{ day}} \times \frac{24 \cancel{\text{ h}}}{1 \cancel{\text{ day}}} \times \frac{60 \cancel{\text{ min}}}{1 \cancel{\text{ h}}} \times \frac{60 \text{ s}}{1 \cancel{\text{ min}}}$$

$$= 86{,}400 \text{ s (in 1 day)}$$

$$300{,}000 \times 86{,}400$$

$$= 25{,}920{,}000{,}000 \text{ km}$$

Light travels 25,920,000,000 km in 1 day.

Projects or Group Activities

45. The current definition of a meter is the length of the path travelled by light in a vacuum during a time interval of $\frac{1}{299{,}792{,}458}$ second.

Section 9.2

Concept Check

1a. Right

b. Left

Objective A Exercises

3. 420 g = 0.420 kg

5. 127 mg = 0.127 g

7. 4.2 kg = 4200 g

9. 0.45 g = 4.5 g

11. 1856 g = 1.856 kg

13. 4057 mg = 4.057 g

15. 1.37 hg = 137 g

17. 0.0456 g = 45.6 mg

19. 18,000 g = 18.000 kg

21. 3 kg 922 g = 3 kg + 0.922 kg = 3.922 kg

23. 7 g 891 mg = 7 g + 0.891 g = 7.891 g

25. 4 kg 63 g = 4 kg + 0.063 kg = 4.063 kg

27. mg

29. g

Objective B Exercises

31. **Strategy** To find the number of tablets to take:
- Convert the amount of the supplement (2 g) to milligrams.
- Divide the amount of the supplement by the amount of calcium in one tablet (500 mg).

Solution 2 g = 2000 mg

$$500\overline{)2000}\quad 4$$

The patient should take 4 tablets per day.

33. **Strategy** To find the number of grams of cholesterol in one dozen eggs:
- Convert the amount of cholesterol that one egg contains (274 mg) to grams.
- Multiply the number of grams of cholesterol in one egg by the number of eggs (12).

Solution 274 mg = 0.274 g

$12 \times 0.274 = 3.288$ g

There are 3.288 g of cholesterol in 12 eggs.

35. **Strategy** To find the cost of the three packages of ground meat:
- Convert the weight of the three packages to kilograms.
- Add the three weights.
- Multiply the sum by \$8.40.

Solution

$$\begin{array}{rr} 470\text{ g} & 0.470\text{ kg} \\ 680\text{ g} & 0.680\text{ kg} \\ 590\text{ g} & +\ 0.590\text{ kg} \\ & \hline & 1.740\text{ kg} \end{array}$$

$1.74 \times 8.40 = 14.616$

The three packages of meat cost \$14.62.

37. **Strategy** To find the weight of two of the knee braces:

- Convert the weight to grams.
- Multiply the result by 2.

Solution 0.136 kg = 136 g

$136 \times 2 = 272$

Two of the knee braces weigh 272 g.

39. Strategy To find the profit:

• Convert the weight of a 10-kilogram container to grams.

• Find the number of bags of nuts in a 10-kilogram container by dividing the total weight in grams by the weight of one bag (200 g).

• Find the cost of the bags by multiplying the number of bags by $.04.

• Add the cost of the bags to the cost of a 10-kilogram container ($75) to find the total cost.

• Multiply the number of bags by $3.89 to find the total revenue.

• Subtract the total cost from the revenue to find the profit.

Solution 10 kg = 10,000 g

10,000 g ÷ 200 g

= 50 bags of nuts

50 × $0.04

= $2 cost of the bags

$75 + $2

= $77 total cost

50 × $3.89

= $194.50 total revenue

$194.50 – $77.00

= $117.50 profit

The profit from repackaging the nuts is $117.50.

41. Strategy To find the total weight, multiply the number of cars (9) by the weight per car (1405 kg).

Solution $1405 \times 9 = 12{,}645$

The total weight of the cars is 12,645 kg.

Critical Thinking

43. Students might list familiarity among the advantages of the U.S. Customary System and difficulty in converting units among the disadvantages. They might list ease of conversion among the advantages of the metric system, as well as the fact that international trade is based on the metric system.

A disadvantage for Americans is that they are unfamiliar with metric units. Another disadvantage is related to American industry: If forced to change to the metric system, companies would face the difficulty and expense of altering the present dimensions of machinery, tools, and products.

Section 9.3

Concept Check

1a. Right

b. Right

Objective A Exercises

3. 4200 ml = 4.200 L

5. 3.42 L = 3420 ml

7. 423 ml = 423 cm^3

9. 642 cm^3 = 642 ml

11. 42 cm^3 = 42 ml = 0.042 L

13. 0.435 L = 435 ml = 435 cm^3

15. 4.62 kl = 4620 L

17. 1423 L = 1.423 kl

19. 1.267 L = 1267 cm^3

21. 3 L 42 ml = 3 L + 0.042 L = 3.042 L

23. 3 kl 4 L = 3 kl + 0.004 kl = 3.004 kl

25. 8 L 200 ml = 8 L + 0.200 L = 8.200 L

27. L

29. L

Objective B Exercises

31. **Strategy** To find the number of servings:
• Convert the amount of milk (3.78 L) to milliliters.
• Divide the amount of milk by the amount of milk in one serving (230 ml).

Solution 3.78 L = 3780 ml
3780 ÷ 230 ≈ 16.43
There are 16 servings in the container of milk.

33. **Strategy** To find how many patients can be immunized:
• Convert 3 cm^3 to liters.
• Divide the total number of liters of flu vaccine (12) by the number of liters of vaccine each person receives.

Solution 3 cm^3 = 3 ml = 0.003 L
12 ÷ 0.003 = 4000
4000 patients can be immunized.

35. **Strategy** To find the number of 240-milliliter servings in one new bottle of Coca-Cola:
- Convert liters to milliliters.
- Divide the number of milliliters in a bottle by the number of milliliters in a serving (240).

Solution 1.25 L = 1250 ml
1250 ÷ 240 ≈ 5
There are approximately five 240-milliliter servings in one new bottle of Coca-Cola.

37. **Strategy** To determine the better buy:
• Find the unit cost (cost per liter) of the 12 one-liter bottles by dividing the cost ($19.80) by the amount of apple juice (12 L).
• Find the unit cost (cost per liter) of the 24 cans by converting the amount to liters and then dividing $14.50 by the amount of juice.

Solution The cost of 12 one-liter bottles:
19.80 ÷ 12 = 1.65
The unit cost is $1.65 per liter.
The cost of 24 cans:
24 × 340 ml = 8160 ml = 8.16 L
14.50 ÷ 8.16 ≈ 1.78
The unit cost is $1.78 per liter.

Since $1.65 < $1.78, the 12 one-liter bottles are the better buy.

39. Strategy To find the profit:

• Convert the volume of 5 L of cough syrup to milliliters.

• Find the number of bottles of cough syrup by dividing the total volume in milliliters by the volume of the 250-ml bottles.

• Find the cost of the bottles by multiplying the number of bottles by the cost per bottle ($.55).

• Add the cost of the bottles to the cost of the 5 L of cough syrup ($95) to find the total cost.

• Multiply the number of bottles by $9.89 to find the total revenue.

• Subtract the total cost from the revenue to find the profit.

Solution

5 L = 5000 ml

5000 ÷ 250 = 20

(Bottles of cough syrup)

20 × 0.55 = 11

(Cost of the bottles)

11 + 95 = 106

(Total cost)

20 × 9.89 = 197.80

(Revenue)

197.80 − 106 = 91.80

(Profit)

The profit was $91.80.

41. Strategy To find the profit:

• Convert the 32 kl of cooking oil to liters.

• Find the number of bottles of cooking oil by dividing the amount of cooking oil by the volume of one bottle (1.25 L)

• Find the cost of the bottles by multiplying the number of bottles by the cost of one bottle ($.42)

• Add the cost of the bottles to the cost of the cooking oil ($64,480) to find the total cost.

• Multiply the number of bottles by $5.94 to find the total revenue.

• Subtract the total cost from the total revenue to find the profit.

Solution

32 kl = 32,000 L

32,000 ÷ 1.25 = 25,600

(Bottles of cooking oil)

25,600 × 0.42 = 10,752

(Cost of the bottles)

10,752 + 64,480 = 75,232

(Total cost)

25,600 × 5.94 = 152,064

(Revenue)

152,064 − 75,232 = 76,832

(Profit)

The total profit was $76,832.

Critical Thinking

43. 3 L − 280 ml = 3 L − 0.280 L = 2.72 L

2.72 L = 2720 ml

2.72 L = 2 L 720 ml

Check Your Progress: Chapter 9

1. 3.856 cg = 0.03856 g

2. 0.2208 kl = 22.08 dal

3. 2.814 dag = 28.14 g

4. 1.852 hl = 185.2 L

5. 336.4 g = 3364 dg

6. 3.445 dg = 0.3445 g

7. 4.35 hl = 43.5 dal

8. 0.01909 L = 0.0001909 hl

9. 0.02773 hl = 27.73 dl

10. 3.405 g = 0.03405 hg

11. 0.02014 dag = 201.4 mg

12. 3.887 km = 38.87 hm

13. 0.01571 kl = 15.71 L

14. 0.1605 g = 1.605 dg

15. 107.7 mm = 10.77 cm

16. 0.01488 dag = 0.1488 g

17. 0.1487 dam = 148.7 cm

18. 0.03376 km = 33.76 m

19. 0.4758 g = 475.8 mg

20. 0.1522 L = 0.0001533 kl

21. 0.01286 km = 128.6 dm

22. 3.498 dag = 3498 cg

23. 1.861 cm = 0.001861 dam

24. 0.03533 kg = 35.33 g

25. 0.4964 hg = 496.4 dg

26. 36.46 cg = 364.6 mg

27. 0.01517 dal = 151.7 ml

28. 0.4839 hm = 4839 cm

29. 25.89 m = 2589 cm

30. 0.0295 dl = 0.00295 L

31. **Strategy** To find the owner's profit:

- Convert 50 L to milliliters.
- Find the number of 500-milliliter bottles in 50 L.
- Multiply the number of bottles by the cost per bottle ($.78).
- Multiply the number of bottles by the selling price per bottle ($13.99).
- Add the cost for the concentrate to the cost for the bottles.
- Subtract the result from the total selling price.

Solution 50 L = 50,000 ml

$50{,}000 \div 500 = 100$ bottles

The bottles cost the owner $100 \times \$.78 = \$78$.

The bottles will sell for $100 \times \$13.99 = \$1399$.

The owner's total cost was $\$450 = \$78 = \$528$.

The owner's profit is $1399 – $528 = $871.

32. **Strategy** To find the number of tablets to take:

- Divide the total medication amount prescribed (100 mg) by the amount of medication in each pill (25 mg).
- Multiply the result by 2.

Solution $100 \div 25 = 4$

Each 100-mg dose can be taken in 4 tablets.

$4 \times 2 = 8$

The patient should take 8 tablets per day.

33. **Strategy** To find the time for the spacecraft to travel:

- Divide the total distance (384,400 km) by the rate of travel (11 km/s)
- Convert the resulting time in seconds to hours.

Solution

$$11\overline{)384,400.00}\quad 34,945.\overline{45}$$

$34,945$ s

$$= 34,945 \text{ s} \times \frac{1 \text{ min}}{60 \text{ s}} \times \frac{1 \text{ h}}{60 \text{ min}}$$

≈ 9.7 h

It would take approximately 9.7 hours.

Section 9.4

Concept Check

1. 1 Calorie = 1000 calories

Objective A Exercises

3. Strategy To find the number of Calories that can be omitted from your diet, multiply the number of Calories omitted each day (110) by the number of days (30).

Solution $110 \times 30 = 3300$

3300 Calories can be omitted from your diet.

5a. Strategy
- From the nutrition label find the number of Calories per serving.
- Multiply the number of Calories per serving by $1\frac{1}{2}$.

Solution There are 60 Calories per serving.

$$60 \times 1\frac{1}{2} = \frac{60}{1} \times \frac{3}{2} = \frac{60 \times 3}{2} = 90$$

There are 90 Calories in $1\frac{1}{2}$ servings.

b. Strategy From the nutrition label find the serving size and the number of Calories from fat.
- Determine how many servings are in 6 slices of bread.
- Multiply the number of fat Calories in a serving by the number of servings.

Solution 2 slices of bread is one serving.

10 fat Calories are in one serving.

$6 \div 2 = 3$ number of servings

$10 \times 3 = 30$

There are 30 fat Calories in 6 slices of bread.

7. Strategy To find how many Calories a 135-pound person would need to maintain body weight, multiply the body weight (135 lb) by the number of Calories per pound needed (15).

Solution $135 \times 15 = 2025$

2025 Calories would be needed.

9. Strategy To find how many Calories you burn up playing tennis:
- Convert 45 min to hours.

• Find how many hours of tennis are played by multiplying the number of days (30) by the time per day in hours.

• Multiply the number of hours played by the Calories burned per hour (450).

Solution

$$45 \text{ min} = 45 \text{ } \cancel{\text{min}} \times \frac{1 \text{ h}}{60 \text{ } \cancel{\text{min}}}$$

$$= \frac{3}{4} \text{ h}$$

$$30 \times \frac{3}{4} \text{h} = \frac{90}{4} \text{ h} = 22.5 \text{ h}$$

450 Calories × 22.5 = 10,125 Calories

You burn 10,125 Calories.

11. Strategy To find how many hours you would have to hike:

• Add to find the total number of Calories consumed (375 + 150 + 280).

• Divide the sum by the number of Calories used in 1 h (315).

Solution

$$\begin{array}{r} 375 \\ 150 \\ +\ 280 \\ \hline 805 \text{ Calories consumed} \end{array} \qquad 805 \div 315 \approx 2.6$$

You would have to hike for 2.6 h.

13. Strategy To find the energy used, multiply the number of watts (500) by the number of hours $2\frac{1}{2}$.

Solution

$$500 \times 2\frac{1}{2} = 1250 \text{ Wh}$$

1250 Wh are used.

15. Strategy To find the number of kilowatt-hours used:

• Find the number of watt-hours used in standby mode.

• Find the number of watt-hours used in operation.

• Add the two numbers.

• Convert watt-hours to kilowatt hours.

Solution

$$\begin{array}{r} 30 \times 9 = \quad 351 \\ 6 \times 36 = +\ 216 \\ \hline 567 \text{ Wh} \end{array}$$

$567 W = 0.567$ kWh

The fax machine used 0.567 kWh.

17. Strategy To find the cost:

• Multiply the watts by the number of hours (8) to find the number of watt-hours.

• Convert the watt-hours to kilowatt-hours.

• Multiply the number of kilowatt-hours by the price per kilowatt-hour ($.12).

Solution

2200W × 8 h = 17,600 Wh

17,600 Wh = 17.6 kWh

17.6 × 0.12 = 2.112 ≈ 2.11

The cost of running an air conditioner is $2.11.

19. **Strategy** To find the cost for each bulb:

• Find the number of watt-hours by multiplying the number of watts by the number of hours.

• Convert watt-hours to kilowatt-hours.

• Multiply the number of kilowatt-hours by the cost per kilowatt hour.

• Find the difference in cost.

Solution Sylvania Long Life Bulb:

$60 \times 150 = 9000$ Wh

9000 Wh $= 9$ kWh

$9 \times 0.108 = 0.972$

Energy Saver Soft White Bulb:

$34 \times 150 = 5100$ Wh

5100 Wh $= 5.1$ kWh

$5.1 \times 0.108 = 0.5508$

$0.972 - 0.5508 = 0.4212$

The energy saver bulb costs $.42 less to operate.

21. (iii)

Projects or Group Activities

23a. Incandescent:

$$60 \text{ W} \times 10{,}000 \text{ h} = 600{,}000 \text{ Wh} = 600 \text{ kWh}$$

Compact fluorescent:

$$14 \text{ W} \times 10{,}000 \text{ h} = 140{,}000 \text{ Wh} = 140 \text{ kWh}$$

b. Incandescent: $600 \text{ kWh} \times \$.12 = \$72$

It takes 10 60-watt incandescent bulbs to illuminate for 10,000 h, so the cost for the bulbs is $\$1.17 \times 10 = \$11.70$.

$\$11.70 = \$72 = \$83.70$

Compact fluorescent:

$140 \text{ kWh} \times \$.12 = \$16.80$

It takes one compact fluorescent bulb to illuminate for 10,000 h, and the bulb costs $2.25.

$\$2.25 + \$16.80 = \$19.05$

The difference in cost is $83.70 – $19.05 = $64.65.

Section 9.5

Concept Check

1a. $\dfrac{1 \text{ lb}}{454 \text{ g}}$

b. $\dfrac{1.61 \text{ km}}{1 \text{ mi}}$

c. $\dfrac{1 \text{ gal}}{3.79 \text{ L}}$

Objective A Exercises

3. $145 \text{ lb} \approx 145 \text{ lb} \times \dfrac{1 \text{ kg}}{2.2 \text{ lb}} = 65.91 \text{ kg}$

5. $2 \text{ c} \approx 2 \text{ c} \times \dfrac{1 \text{ pt}}{2 \text{ c}} \times \dfrac{1 \text{ qt}}{2 \text{ pt}} \times \dfrac{1 \text{ L}}{1.06 \text{ qt}} \approx 0.47 \text{ L}$

7. $14.3 \text{ gal} \approx 14.3 \text{ gal} \times \dfrac{3.79 \text{ L}}{1 \text{ gal}} \approx 54.20 \text{ L}$

9. $29 \text{ ft } 2 \text{ in.} \approx 29.17 \text{ ft}$

$29.17 \text{ ft} = 29.17 \text{ ft} \times \dfrac{1 \text{ m}}{3.28 \text{ ft}} \approx 8.89 \text{ m}$

11. $30 \dfrac{\text{mi}}{\text{h}} \approx 30 \dfrac{\text{mi}}{\text{h}} \times \dfrac{1.61 \text{ km}}{1 \text{ mi}} = 48.3 \dfrac{\text{km}}{\text{h}}$

13. $\dfrac{\$.59}{\text{lb}} \approx \dfrac{\$.59}{\text{lb}} \times \dfrac{2.2 \text{ lb}}{1 \text{ kg}} \approx \$1.30/\text{kg}$

15. $\frac{\$32.99}{\text{gal}} \approx \frac{\$32.99}{\cancel{\text{gal}}} \times \frac{1\ \cancel{\text{gal}}}{3.79\ \text{L}} \approx \$8.70/\text{L}$

17. $78 \times 2.0745\ \text{mi} = 161.\ \text{mi}$

$$= 161.811\ \text{mi} \times \frac{1.61\ \text{km}}{1\ \text{mi}}$$

$$\approx 260.52\ \text{km}$$

Objective B Exercises

19. $100\ \text{m} \approx 100\ \cancel{\text{m}} \times \frac{3.28\ \text{ft}}{1\ \cancel{\text{m}}} = 328\,\text{ft}$

21. $6\ \text{L} \approx 6\ \cancel{\text{L}} \times \frac{1\ \text{gal}}{3.79\ \cancel{\text{L}}} \approx 1.58\ \text{gal}$

23. $1500\ \text{m} \approx 1500\ \cancel{\text{m}} \times \frac{3.28\ \text{ft}}{1\ \cancel{\text{m}}} = 4920\ \text{ft}$

25. $327\ \text{g} \approx 327\ \cancel{\text{g}} \times \frac{1\ \text{oz}}{28.35\ \cancel{\text{g}}} \approx 11.53\ \text{oz}$

27. $\frac{80\ \text{km}}{\text{h}} \approx \frac{80\ \cancel{\text{km}}}{\text{h}} \times \frac{1\ \text{mi}}{1.61\ \cancel{\text{km}}} \approx 49.69\,\text{mph}$

29. $\frac{\$1.015}{\text{L}} \approx \frac{\$1.015}{\cancel{\text{L}}} \times \frac{3.79\ \cancel{\text{L}}}{\text{gal}} \approx \$3.85/\text{gal}$

31. $2.1\ \text{kg} \approx 2.1\ \cancel{\text{kg}} \times \frac{2.2\ \text{lb}}{\cancel{\text{kg}}} = 4.62\ \text{lb}$

33. **Strategy** To find the number of pounds lost:

- Multiply to find the number of hours spent hiking.
- Multiply the number of hours spent hiking by the number of extra Calories used in hiking to find the total number of extra Calories used.
- Multiply the number of extra Calories consumed each day by the number of days.
- Subtract to find the difference between the number of Calories used in hiking and the number of extra Calories consumed.
- Divide the difference by 3500.

Solution $5 \times 5 = 25$

$25 \times 320 = 8000$

$5 \times 900 = 4500$

$8000 - 4500 = 3500$

$\frac{3500}{3500} = 1$

Gary will lose 1 lb.

Applying the Concepts

35a. False

b. False

c. True

d. False

Projects or Group Activities

37. Answers will vary.

Chapter 9 Review Exercises

1. 1.25 km = 1250 m

2. 0.450 g = 450 mg

3. 0.0056 L = 5.6 ml

4. $1000\ \text{m} \approx 1000\ \cancel{\text{m}} \times \frac{1.09\ \text{yd}}{1\ \cancel{\text{m}}} = 1090\ \text{yd}$

5. 79 mm = 7.9 cm

6. 5 m 34 cm = 5 m + 0.34 m = 5.34 m

7. 990 g = 0.990 kg

8. 2550 ml = 2.550 L

9. 4870 m = 4.870 km

10. 0.37 cm = 3.7 mm

11. 6 g 829 mg = 6 g + 0.829 g = 6.829 g

12. 1.2 L = 1200 cm^3

13. 4.050 kg = 4050 g

14. 8.7 m = 870 cm

15. 192 ml = 192 cm^3

16. 356 mg = 0.356 g

17. 372 cm = 3.72 m

18. 8.3 kl = 8300 L

19. 2 L 89 ml = 2 L + 0.089 L = 2.089 L

20. 5410 cm^3 = 5.410 L

21. 3792 L = 3.792 kl

22. 468 cm^3 = 468 ml

23. **Strategy** To find the amount of the wire left on the roll:
- Convert the lengths of the three pieces cut from the roll to meters.
- Add the three numbers.
- Subtract the sum from the length of the original roll (50 m).

Solution

240 cm = 2.40 m
560 cm = 5.60 m
480 cm = + 4.80 m
12.80 m

50.0 m
−12.8 m
37.2 m

There are 37.2 m of wire left on the roll.

24. **Strategy** To find the total cost:
- Convert the weights of the packages to kilograms.
- Add the weights.
- Multiply the total weight by the cost per kilogram ($5.59).

Solution

790 g = 0.790 kg
830 g = 0.830 kg
655 g = + 0.655 kg
2.275 kg

2.275 × 5.59 = 12.71725

The total cost of the chicken is $12.72.

25. $\frac{\$4.40}{\text{lb}} \approx \frac{\$4.40}{\cancel{\text{lb}}} \times \frac{2.2\ \cancel{\text{lb}}}{1\ \text{kg}} = \$9.68/\text{kg}$

26. **Strategy** To find how many liters of coffee should be prepared:
- Convert 400 ml to liters.
- Multiply the number of guests expected to attend (125) by the number of liters per guest.

Solution

400 ml = 0.4 L

0.4 L × 125 = 50 L

The amount of coffee that should be prepared is 50 L.

27. **Strategy** To find the number of Calories that can be eliminated, multiply the number of Calories in one egg (90) by the number of days it is eliminated (30).

Solution

90 Cal × 30 = 2700 Cal

You can eliminate 2700 Calories.

28. **Strategy** To find the cost of running the TV set:

• Find the number of hours the TV is used each month by multiplying the number of hours per day (5) by the number of days (30).
• Find the number of watt-hours by multiplying the number of watts per hour (240) by the total number of hours.
• Convert watt-hours to kilowatt-hours.
• Multiply the number of kilowatt-hours by the cost per kilowatt-hour (9.5¢).

Solution $5 \text{ h} \times 30 = 150 \text{ h}$
$150 \text{ h} \times 240 \text{ W} = 36{,}000 \text{ Wh}$
$36{,}000 \text{ Wh} = 36 \text{ kWh}$
$36 \times (0.095) = 3.42$
The cost of running the TV set is \$3.42.

29. $1.90 \text{ kg} = 1.90 \text{ } \cancel{\text{kg}} \times \dfrac{2.2 \text{ lb}}{1 \text{ } \cancel{\text{kg}}} = 4.18 \text{ lb}$

30. Strategy To find how many hours of cycling are necessary to lose 1 lb, divide 1 lb (3500 Calories) by the number of Calories cycling burns per hour (400).

Solution
$$400\overline{)3500.00}\quad 8.75$$
8.75 hours of cycling are needed.

31. Strategy To find the profit:
• Convert the amount of soap purchased (6 L) to milliliters.
• Divide the volume of one plastic container (150 ml) into the amount of soap purchased to determine the number of containers of soap for sale.
• Multiply the number of containers by the cost per container (\$.26) to find the cost of the containers.
• Multiply the number of liters of soap (6) by the cost per liter (\$11.40) to find the cost of the soap.
• Add the cost of the soap and the cost of the containers to find the total cost.
• Multiply the number of containers by \$3.29 to find the total revenue.
• Subtract the total cost from the total revenue to find the profit.

Solution $6 \text{ L} = 6000 \text{ ml}$
(amount of soap)
$6000 \div 150 = 40$
(number of containers)
$40 \times 0.26 = 10.40$
(cost of containers)
$6 \times 11.40 = 68.40$
(cost of soap)
$10.40 + 68.40 = 78.80$
(total cost)
$40 \times 3.29 = 131.60$ (revenue)
$131.60 - 78.80 = 52.80$
The profit was \$52.80.

32. Strategy To find the number of kilowatt-hours of energy

used:

• Multiply 80 W times 2 h times 7 days to find the number of watt-hours used.

• Convert the watt-hours to kilowatt-hours.

Solution $80 \times 2 \times 7 = 1120$ Wh

1120 Wh = 1.120 kWh

The color TV used 1.120 kWh of electricity.

33. Strategy To find the amount of fertilizer:

• Multiply the number of trees (500) by the amount of fertilizer per tree (250 g).

• Convert the grams to kilograms.

Solution $500 \times 250 = 125{,}000$ g

125,000 g = 125 kg

The amount of fertilizer used was 125 kg.

Chapter 9 Test

1. 2.96 km = 2960 m

2. 0.378 g = 378 mg

3. 0.046 L = 46 ml

4. 919 cm^3 = 919 ml

5. 42.6 mm = 4.26 cm

6. 7 m 96 cm = 7 m + 0.96 m = 7.96 m

7. 847 g = 0.847 kg

8. 3920 ml = 3.920 L

9. 5885 m = 5.885 km

10. 1.5 cm = 15 mm

11. 3 g 89 mg = 3 g + 0.089 g = 3.089 g

12. 1.6 L = 1600 cm^3

13. 3.29 kg = 3290 g

14. 4.2 m = 420 cm

15. 96 ml = 96 cm^3

16. 1375 mg = 1.375 g

17. 402 cm = 4.02 m

18. 8.92 kl = 8920 L

19. Strategy To find the number of Calories needed to maintain the weight of a 140-pound sedentary person, multiply the weight (140 pounds) by the number of Calories per pound a sedentary person needs (15) to maintain weight.

Solution $140 \times 15 = 2100$

A 140-pound sedentary person should consume 2100 Calories per day to maintain that weight.

20. Strategy To find the number of kilowatt-hours of energy used:

• Multiply 100 W times $4\frac{1}{2}h$ times 7 days to find the number of watt-hours used.

• Convert the watt-hours to kilowatt-hours.

Solution $100 \times 4\frac{1}{2} \times 7 = 3150$ Wh

3150 Wh = 3.15 kWh

3.15 kWh of energy are used during the week for operating the television.

21. Strategy To find the total length of the rafters:

• Multiply the number of rafters (30) by the length of each rafter (380 cm).

• Convert the length in centimeters to meters.

Solution $30 \times 380 = 11{,}400$ cm

11,400 = 114 m

The total length of the rafters is 114 m.

22. Strategy To find the weight of the box of tiles, multiply the weight of one tile (250 g) by the number of tiles in the box (144).

Solution
$$\begin{array}{r} 250 \text{ g} \\ \times \quad 144 \\ \hline 36{,}000 \text{ g} \end{array} = 36 \text{ kg}$$

The weight of the box is 36 kg.

23. Strategy To find how many liters of vaccine are needed:

• Multiply the number of people (2600) by the amount of vaccine per flu shot (2 cm^3).

• Convert the total amount of vaccine to liters.

Solution
$$\begin{array}{r} 2600 \\ \times \quad 2 \text{ cm}^3 \\ \hline 5200 \text{ cm}^3 \end{array} = 5.2 \text{ L}$$

The amount of vaccine needed is 5.2 L.

24. $35 \text{ mph} \approx \frac{35 \text{ mi}}{\text{h}} \times \frac{1.61 \text{ km}}{1 \text{ mi}} \approx 56.4 \text{ km/h}$

25. Strategy To find the distance between the rivets:

• Convert the length of the plate (4.20 m) to centimeters.

• Divide the length of the plate by the number of spaces (24).

Solution 4.20 m = 420 cm

$420 \div 24 = 17.5$ cm

The distance between the rivets is 17.5 cm.

26. Strategy To find how much it costs to fertilize the orchard:

• Find out how much fertilizer is needed by multiplying the number of trees in the orchard (1200) by the amount of fertilizer for each tree (200 g).

• Convert the total amount of fertilizer to kilograms.

• Multiply the number of kilograms of fertilizer by the cost per kilogram ($2.75).

Solution $1200 \times 200 = 240{,}000$ g

240,000 g = 240 kg

$240 \times 2.75 = 660$

The cost to fertilize the trees is $660.

27. Strategy To find the cost of the electricity:

• Determine the amount of electricity used by multiplying 1600 W times the hours used per day (4) times the number of days (30).

• Convert the watt-hours to kilowatt-hours.

• Multiply the kilowatt-hours by the cost per kilowatt hour ($.125).

Solution $1600 \times 4 \times 30 = 192{,}000$ Wh

192,000 Wh = 192 kWh

$192 \times 0.125 = 24.00$

The total cost is $24.00.

28. Strategy To find how much acid should be ordered:

• Find the amount of acid needed by multiplying the number of classes (3) times the number of students in each class (40) times the amount of acid needed by each student (90).

• Convert the amount to liters.

Solution $3 \times 40 \times 90 = 10{,}800$ ml

10.8 L

The assistant should order 11 L of acid.

29. Strategy Convert the measure of the large hill (120 m) to feet.

Solution
$$120 \text{ m} = 120 \text{ } \cancel{\text{m}} \times \frac{3.28 \text{ ft}}{1 \text{ } \cancel{\text{m}}}$$
$$= 393.6 \text{ ft}$$

The measure of the large hill is 393.6 ft.

30. Strategy Convert the measure of the diameter of the bulls eye (4.8 in.) to centimeters.

Solution
$$4.8 \text{ in.} = 4.8 \text{ } \cancel{\text{in.}} \times \frac{2.54 \text{ cm}}{1 \text{ } \cancel{\text{in.}}}$$
$$= 12.192 \text{ cm}$$

4.8 in. is approximately 12.2 cm.

Cumulative Review Exercises

1. $12 - 8 \div (6-4)^2 \cdot 3 = 12 - 8 \div 2^2 \cdot 3$
$= 12 - 8 \div 4 \cdot 3$
$= 12 - 2 \cdot 3$
$= 12 - 6$
$= 6$

2.
$$5\frac{3}{4} = 5\frac{27}{36}$$
$$1\frac{5}{6} = 1\frac{30}{36}$$
$$+ \; 4\frac{7}{9} = 4\frac{28}{36}$$
$$10\frac{85}{36} = 12\frac{13}{36}$$

3.
$$4\frac{2}{9} = 4\frac{8}{36} = 3\frac{44}{36}$$
$$- \; 3\frac{5}{12} = 3\frac{15}{36} = 3\frac{15}{36}$$
$$\frac{29}{36}$$

4. $5\frac{3}{8} \div 1\frac{3}{4} = \frac{43}{8} \div \frac{7}{4}$
$= \frac{43}{8} \times \frac{4}{7}$
$= \frac{43 \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}}}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 2 \cdot 7} = \frac{43}{14} = 3\frac{1}{14}$

5. $\left(\frac{2}{3}\right)^4 \cdot \left(\frac{9}{4}\right)^2 = \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} \quad \frac{9}{4} \cdot \frac{9}{4}$
$= \frac{16}{81} \cdot \frac{81}{16} = 1$

6. $12.0072 - 9.937 = 2.0702$

7. $\frac{5}{8} = \frac{n}{50}$

$5 \times 50 = 8 \times n$

$250 = 8 \times n$

$250 \div 8 = n$

$n = 31.3$

8. $1\frac{3}{4} = \frac{7}{4} \times 100\% = \frac{700}{4}\% = 175\%$

9. $4.2\% \times n = 6.09$

$0.042 \times n = 6.09$

$n = 6.09 \div 0.042 = 145$

10. $18 \text{ pt} \times \frac{1 \text{ qt}}{2 \text{ pt}} \times \frac{1 \text{ gal}}{4 \text{ qt}} = \frac{18}{8} \text{ gal} = 2.25 \text{ gal}$

11. 875 cm = 8.75 m

12. 3420 m = 3.420 km

13. 5.05 kg = 5050 g

14. 3 g 672 mg = 3 g + 0.672 g = 3.672 g

15. 6 L = 6000 ml

16. 2.4 kl = 2400 L

17. **Strategy** To find how much money is left after the rent is paid:

- Find the amount that is paid in rent by multiplying $\frac{1}{4}$ by the total monthly income ($5244).
- Subtract the amount paid in rent from the total monthly income.

Solution $\frac{1}{4} \times 5244 = \frac{5244}{4} = 1311$

$5244 - 1311 = 3933$

$3933 is left after the rent is paid.

18. **Strategy** To find the amount of income tax paid:

- Find the amount of income tax paid on the profit by multiplying 0.08 by the profit ($82,340).
- Add $620 to the amount of income tax paid on the profit.

Solution $0.08 \times 82{,}340 = 6587.20$

$6587.20 + 620.00 = 7207.20$

The business paid $7207.20 in income tax.

19. **Strategy** To find the property tax, solve a proportion.

Solution

$$\frac{\$4900}{\$245{,}000} = \frac{n}{\$275{,}000}$$

$4900 \times 275{,}000 = 245{,}000 \times n$

$1{,}347{,}500{,}000 = 245{,}000 \times n$

$1{,}347{,}500{,}000 \div 245{,}000 = n$

$5500 = n$

The property tax is $5500.

20. **Strategy** To find the rebate, solve the basic percent equation for amount. The base is $23,500 and the rate is 12%.

Solution Percent × base = amount

$12\% \times 23{,}500 = n$

$0.12 \times 23{,}500 = n$

$2820 = n$

The car buyer will receive a rebate of $2820.

21. Strategy To find the percent, solve the basic percent equation for percent. The base is $8200 and the amount is $533.

Solution Percent × base = amount

$$n \times 8200 = 533$$
$$n = 533 \div 8200$$
$$n = 0.065 = 6.5\%$$

The percent is 6.5%.

22. Strategy To find your mean grade, find the sum of the grades and divide the sum by the number of grades (5).

Solution

$$\begin{array}{r} 78 \\ 92 \\ 45 \\ 80 \\ +\ 85 \\ \hline 380 \end{array}$$ sum of grades

$$5\overline{)380}\quad 76$$

Your average grade is 76.

23. Strategy To find what the salary will be next year, find the amount of the increase by solving the basic percent equation for amount. The base is $22,500 and the percent is 12%.

Solution Percent × base = amount

$$12\% \times 22{,}500 = n \qquad 0.12 \times 22{,}500 = n \qquad 2700 = n$$

$$\begin{array}{r} 22{,}500 \\ +\ 2{,}700 \\ \hline 25{,}200 \end{array}$$

Karla's salary next year will be $25,200.

24. Strategy To find the discount rate:

• Find the amount of the discount by subtracting the sale price ($140.40) from the original price ($180).

• Solve the basic percent equation for percent. The base is the original price ($180) and the amount is the amount of the discount.

Solution

$$\begin{array}{r} 180.00 \\ -\ 140.40 \\ \hline 39.60 \end{array}$$

Percent × base = amount

$$n \times 180 = 39.60$$
$$n = 39.60 \div 180$$
$$n = 0.22 = 22\%$$

The discount rate is 22%.

25. Strategy To find the length of the wall:

• Convert 9 in. to feet.

• Multiply the length, in feet, of one brick by the number of bricks (48).

Solution

$$9 \text{ in.} = 9 \cancel{\text{in.}} \times \frac{1 \text{ ft}}{12 \cancel{\text{in.}}}$$
$$= \frac{9}{12} \text{ ft} = 0.75 \text{ ft}$$

$$48 \times 0.75 = \frac{48}{1} \times \frac{3}{4} = 36$$

The length of the wall is 36 ft.

26. Strategy To find the number of miles traveled on 1 gal of fuel, write and solve a proportion using n to represent the number of miles traveled on 1 gal of fuel.

Solution

$$\frac{11.2 \text{ mi}}{20 \text{ gal}} = \frac{n}{1 \text{ gal}}$$

$$11.2 \times 1 = 20 \times n$$

$$11.2 = 20 \times n$$

$$11.2 \div 20 = n$$

$$0.56 = n$$

The tank travels 0.56 mi on 1 gal of fuel.

27. Strategy To find the profit:

- Convert the amount of oil to quarts.
- Find the cost by multiplying the number of gallons (40) by the cost per gallon ($24.40).
- Find the revenue by multiplying the number of quarts by the selling price per quart ($9.95).
- Subtract the cost from the revenue.

Solution

$$40 \text{ gal} = 40 \text{ } \cancel{\text{gal}} \times \frac{4 \text{ qt}}{1 \text{ } \cancel{\text{gal}}}$$

$$= 160 \text{ quarts}$$

$40 \times 24.40 = 976$ cost

$160 \times 9.95 = 1592$ revenue

$1592 - 976 = 616$

The profit was $616.00.

28. Strategy To find the amount of chlorine used:

- Convert the amount of chlorine used to liters.
- Multiply the amount used each day by the number of days (20).

Solution 1200 ml = 1.2 L

$1.2 \text{ L} \times 20 = 24$ L

24 L of chlorine was used.

29. Strategy To find how much it costs to operate the hairdryer:

- Find how many hours the hair dryer is used by multiplying the amount used each day $\frac{1}{2}h$ by the number of days (30).
- Find the watt-hours by multiplying the number of watts (1200) by the number of hours.
- Convert watt-hours to kilowatt-hours.
- Multiply the number of kilowatt-hours by the cost per kilowatt-hour (13.5¢).

Solution

$$30 \times \frac{1}{2}h = 15h$$

$1200\text{W} \times 15 \text{ h} = 18{,}000$ Wh

18,000 Wh = 18 kWh

$18 \times 0.135 = 2.43$

The total cost of operating the hair dryer is $2.43.

30. $\frac{60 \text{ mi}}{1 \text{ h}} = \frac{60 \text{ } \cancel{\text{mi}}}{1 \text{ h}} \times \frac{1.61 \text{ km}}{1 \text{ } \cancel{\text{mi}}} = 96.6 \text{ km/h}$

Chapter 10: Rational Numbers

Prep Test

1. $54 > 45$

2. 4 units

3. $7654 + 8193 = 15{,}847$

4. $6097 - 2318 = 3779$

5. $472 \times 56 = 26{,}432$

6. $\dfrac{144}{24} = \dfrac{2 \cdot \cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{2}^{1} \cdot 3 \cdot \cancel{3}^{1}}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{3}}} = 6$

7. $\dfrac{2}{3} + \dfrac{3}{5} = \dfrac{10}{15} + \dfrac{9}{15}$

$= \dfrac{19}{15} = 1\dfrac{4}{15}$

8. $\dfrac{3}{4} - \dfrac{5}{16} = \dfrac{12}{16} - \dfrac{5}{16}$

$= \dfrac{7}{16}$

9. $0.75 + 3.9 + 6.408 = 11.058$

10. $5.4 - 1.619 = 3.781$

11. $\dfrac{3}{4} \times \dfrac{8}{15} = \dfrac{\cancel{3}^{1} \cdot \cancel{2}^{1} \cdot \cancel{2}^{1} \cdot 2}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{3}} \cdot 5} = \dfrac{2}{5}$

12. $\dfrac{5}{12} \div \dfrac{3}{4} = \dfrac{5}{12} \cdot \dfrac{4}{3}$

$= \dfrac{5 \cdot \cancel{2}^{1} \cdot \cancel{2}^{1}}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 3 \cdot 3} = \dfrac{5}{9}$

13. $23.5 \times 0.4 = 9.4$

14.

$$2.4\overline{)0.9.6}$$
$$0.4$$

15. $(8-6)^2 + 12 \div 4 \cdot 3^2 = 2^2 + 12 \div 4 \cdot 9$

$= 4 + 3 \cdot 9$

$= 4 + 27$

$= 31$

Section 10.1

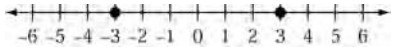
Concept Check

1. –120 ft

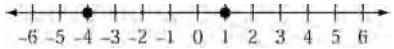
3. Yes

Objective A Exercises

5.



7.



9. $-2 > -5$

11. $-16 < 1$

13. $-11 < -8$

15. $-42 < 0$

17. $21 > -34$

19. $0 > -39$

21. $-87 < 63$

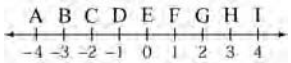
23. $-62 > -84$

25. 1

27. –1

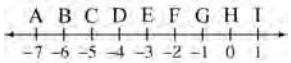
29. 3

31.



a. *A* is –4.

b. *C* is –2.

33. 

a. A is –7.

b. D is –4.

35. –12° F

37. –42 ft

39. –4, 0, 5, 9

41. –10, –7, –5, 4, 12

43. –11, –7, –2, 5, 10

45. Always true

47. Sometimes true

Objective B Exercises

49. –16

51. 3

53. 0

55. 59

57. 88

59. 4

61. 9

63. 11

65. 12

67. $|-2| = 2$

69. $|6| = 6$

71. $|16| = 16$

73. $|-12| = 12$

75. $-|29| = -29$

77. $-|-14| = -14$

79. $|-15| = 15$

81. $-|33| = -33$

83. $|32| = 32$

85. $-|-42| = -42$

87. $|-61| = 61$

89. $-|52| = -52$

91. $|-12| = 12$, $|8| = 8$; $|-12| > |8|$

93. $|6| = 6$, $|13| = 13$; $|6| < |13|$

95. $|-1| = 1$, $|-17| = 17$; $|-1| < |-17|$

97. $|17| = 17$, $|-17| = 17$; $|17| = |-17|$

99. $-3, 22, -25, 37$

101. $10, -23, 42, -49$

103. $9, 23, -28, -40$

105. Positive integers

107. Negative integers

Critical Thinking

109a. 8 and –2 are 5 units from 3.

b. 2 and –4 are 3 units from –1.

111. –12 min and counting is closer to blastoff.

113. The loss was greater during the first quarter.

Projects or Group Activities

115. Answers will vary.

Section 10.2

Concept Check

1. –14, –364

3. Negative six minus positive four

5. Positive six minus negative four

Objective A Exercises

7. $3 + (-5) = -2$

9. $8 + 12 = 20$

11. $-3 + (-8) = -11$

13. $-4 + (-5) = -9$

15. $6 + (-9) = -3$

17. $-6 + 7 = 1$

19. $2 + (-3) + (-4) = -1 + (-4) = -5$

21. $-3 + (-12) + (-15) = -15 + (-15) = -30$

23. $-17 + (-3) + 29 = -20 + 29 = 9$

25. $-3 + (-8) + 12 = -11 + 12 = 1$

27. $13 + (-22) + 4 + (-5) = -9 + 4 + (-5)$
$= -5 + (-5) = -10$

29. $-22 + 10 + 2 + (-18) = -12 + 2 + (-18)$
$= -10 + (-18) = -28$

31. $-16 + (-17) + (-18) + 10 = -33 + (-18) + 10$
$= -51 + 10 = -41$

33. $-126 + (-247) + (-358) + 339$
$= -373 + (-358) + 339$
$= -731 + 339$
$= -392$

35. $-12 + (-8) = -20$

37. $-7 + (-16) = -23$

39. $-4 + 2 = -2$

41. $-2 + 8 + (-12) = 6 + (-12) = -6$

43. $2 + (-3) + 8 + (-13) = -1 + 8 + (-13)$
$= 7 + (-13) = -6$

45. Always true

47. Sometimes true

Objective B Exercises

49. $16 - 8 = 16 + (-8) = 8$

51. $7 - 14 = 7 + (-14) = -7$

53. $-7 - 2 = -7 + (-2) = -9$

55. $7 - (-29) = 7 + 29 = 36$

57. $-6 - (-3) = -6 + 3 = -3$

59. $6 - (-12) = 6 + 12 = 18$

61. $-4 - 3 - 2 = -4 + (-3) + (-2)$
$= -7 + (-2) = -9$

63. $12 - (-7) - 8 = 12 + 7 + (-8)$
$= 19 + (-8) = 11$

65. $4 - 12 - (-8) = 4 + (-12) + 8$
$= -8 + 8 = 0$

67. $-6 - (-8) - (-9) = -6 + 8 + 9$
$= 2 + 9 = 11$

69. $-30 - (-65) - 29 - 4$
$= -30 + 65 + (-29) + (-4)$
$= 35 + (-29) + (-4)$
$= 6 + (-4) = 2$

71. $-16 - 47 - 63 - 12$
$= -16 + (-47) + (-63) + (-12)$
$= -63 + (-63) + (-12)$
$= -126 + (-12)$
$= -138$

73. $47 - (-67) - 13 - 15$
$= 47 + 67 + (-13) + (-15)$
$= 114 + (-13) + (-15)$
$= 101 + (-15) = 86$

75. $167 - 432 - (-287) - 359$
$= 167 + (-432) + 287 + (-359)$
$= -265 + 287 + (-359)$
$= 22 + (-359)$
$= -337$

77. $-4-(-8)=-4+8=4$

79. $-8-4=-8+(-4)=-12$

81. $-4-8=-4+(-8)=-12$

83. $1-(-2)=1+2=3$

85. Never true

87. Sometimes true

Objective C Exercises

89. **Strategy** To find the difference between the temperatures, subtract the smaller number (–51°C) from the larger number (–7°C).

Solution $-7-(-51)=-7+51=44$

The difference in the temperatures is 44°C.

91. **Strategy** To find the temperature, add the increase (7°C) to the previous temperature (–8°C).

Solution $-8+7=-1$

The temperature is –1°C.

93. Above

95. **Strategy** To find Nick's score, subtract 26 points from his original score (11).

Solution $11-26=11+(-26)=-15$

Nick's score was –15 points after his opponent shot the moon.

97. **Strategy** To find the price of Byplex stock add the change in price for each day of the week.

Solution
$$\begin{aligned}&-2+(-3)+(-1)+(-2)+(-1)\\&=-5+(-1)+(-2)+(-1)\\&=-6+(-2)+(-1)\\&=(-8)+(-1)\\&=-9\end{aligned}$$

The change in the price of the stock is –9 dollars.

99. **Strategy** To find the difference in temperature, subtract the temperature in Earth's stratosphere (–70°F) from the temperature of Earth's surface (45°F).

Solution $45-(-70)=45+70=115$

The difference is 115°F.

101. **Strategy** To find the difference in elevation, subtract the elevation of Lake Assal (–156 m) from the elevation of Mt. Kilimanjaro (5895 m).

Solution
$$\begin{aligned}&5895-(-156)\\&=5895+156\\&=6051\end{aligned}$$

The difference in elevation is 6051 m.

Critical Thinking

103. The largest difference: $13-(-9)=22$

The smallest positive difference: $-7-(-9)=2$ or

$-5-(-7)=-5+7=2$

105. There are 4 possibilities:

$$-7+(-1)=-8$$
$$-6+(-2)=-8$$
$$-5+(-3)=-8$$
$$-4+(-4)=-8$$

Projects or Group Activities

107. 8 blue chips together with 10 red chips yields 2 red chips; $8 + (-10) = -2$

109. 5 red chips together with 5 blue chips yields 0 chips; $-5 + 5 = 0$

111. To 4 red chips add 5 pairs of red and blue chips. Remove 5 blue chips. The result is 9 red chips.; $-4 - 5 = -9$

Section 10.3

Concept Check

1a. Positive

b. Undefined

c. Negative

d. Zero

Objective A Exercises

3. $14 \times 3 = 42$

5. $-4 \cdot 6 = -24$

7. $-2 \cdot (-3) = 6$

9. $(9)(2) = 18$

11. $5\ (-4) = -20$

13. $-8(2) = -16$

15. $(-5)\ (-5) = 25$

17. $(-7)\ (0) = 0$

19. $(-6)^2 = (-6)(-6) = 36$

21. $-2^3 = -(2 \cdot 2 \cdot 2) = -8$

23. $(-5)^4 = (-5)(-5)(-5)(-5) = 625$

25. $-6 \cdot 38 = -228$

27. $8\ (-40) = -320$

29. $-4\ (39) = -156$

31. $5 \cdot 7 \cdot (-2) = 35 \cdot (-2) = -70$

33. $-9(-9)\ (2) = 81\ (2) = 162$

35. $-5\ (8)\ (-3) = -40\ (-3) = 120$

37. $-1\ (4)\ (-9) = -4\ (-9) = 36$

39. $4\ (-4)(6)(-2) = -16(6)(-2) = -96\ (-2) = 192$

41. $-9\ (4)(3)(1) = -36(3)(1) = -108\ (1) = -108$

43. $(-6)(7)(-10)(-5) = -42(-10)(-5)$
$= 420(-5)$
$= -2100$

45. $-5\ (-4) = 20$

47. $-8\ (6) = -48$

49. $-4\ (7)\ (-5) = -28\ (-5) = 140$

51. Negative

53. Zero

Objective B Exercises

55. $3\ (-12) = -36$

57. $-5\ (11) = -55$

59. $12 \div (-6) = -2$

61. $(-72) \div (-9) = 8$

63. $0 \div (-6) = 0$

65. $45 \div (-5) = -9$

67. $-36 \div 4 = -9$

69. $-81 \div (-9) = 9$

71. $\frac{72}{-3} = -24$

73. $\frac{-60}{5} = -12$

75. $\frac{-93}{-3} = 31$

77. $\frac{-85}{-5} = 17$

79. $\frac{120}{8} = 15$

81. $\frac{78}{-6} = -13$

83. $-72 \div 4 = -18$

85. $-114 \div (-6) = 19$

87. $-104 \div (-8) = 13$

89. $57 \div (-3) = -19$

91. $-136 \div (-8) = 17$

93. $-130 \div (-5) = 26$

95. $-92 \div (-4) = 23$

97. $-150 \div (-6) = 25$

99. $\frac{204}{-6} = -34$

101. $\frac{-132}{-12} = 11$

103. $\frac{-182}{14} = -13$

105. $143 \div 11 = 13$

107. $-180 \div (-15) = 12$

109. $154 \div (-11) = -14$

111. $\frac{182}{-13} = -14$

113. $\frac{144}{-24} = -6$

115. $\frac{-88}{22} = -4$

117. Never true

119. Always true

Objective C Exercises

121. **Strategy** To find the average daily high temperature:
• Add the seven temperature readings.
• Divide by 7.

Solution

$$\begin{aligned}
&-6 + (-11) + 1 + 5 + (-3) + (-9) + (-5)\\
&= -17 + 1 + 5 + (-3) + (-9) + (-5)\\
&= -16 + 5 + (-3) + (-9) + (-5)\\
&= -11 + (-3) + (-9) + (-5)\\
&= -14 + (-9) + (-5)\\
&= -23 + (-5)\\
&= -28\\
&-28 \div 7 = -4
\end{aligned}$$

The average high temperature was –4°F.

123. False

125. **Strategy** To find the average score, divide the combined scores (–20) by the number of golfers (10).

Solution $-20 \div 10 = -2$

The average score was –2.

127. **Strategy** To find the wind chill factor, multiply the wind chill factor at 10°F with a 20 mph wind (–9°F) by 5.

Solution $-9 \times 5 = -45$

The wind chill factor is –45°F.

129. **Strategy** To find the student's score:

• Multiply the number of questions answered correctly (20) by 5. Multiply the number of questions left blank (2) by –2. Multiply the number of questions answered incorrectly (5) by –5.

• Add the three products.

Solution
$$20 \times 5 = 100$$
$$2 \times (-2) = -4$$
$$5 \times (-5) = -25$$
$$100 + (-4) + (-25)$$
$$= 96 + (-25) = 71$$

The student's score was 71.

Applying the Concepts

131a. True

b. True

Projects or Group Activities

133. Answers will vary.

Check Your Progress: Chapter 10

1. $-12 > -15$

2. $0 > -11$

3. $-49 < 4$

4. $|-7| = 7$

5. $-|21| = -21$

6. $|0| = 0$

7. $-15 + 27 = 12$

8. $-25 + (-20) = -45$

9. $-17 - (-23) = -17 + 23 = 6$

10. $-5 - 11 = -5 + (-11) = -16$

11. $0 - (-13) = 0 + 13 = 13$

12. $-48 + 0 = -48$

13. $-12(-7) = 84$

14. $5(-15) = -75$

15. $-23(0) = 0$

16. $-50 \div 10 = -5$

17. $0 \div (-7) = 0$

18. $-84 \div (-7) = 12$

19. $-9 + 12 = 3$

20. $-54 \div -6 = 9$

21. $-9 - 7 = -9 + (-7) = -16$

22. $17 + (-23) = -6$

23. $-8(-9) = 72$

24. $13 + (-13) = 0$

25. **Strategy** To find the difference, subtract the smaller number (-223) from the larger number (-183).

Solution
$$-183 - (-223)$$
$$= -183 + 223$$
$$= 40$$

The difference in temperature is 40° C.

Section 10.4

Concept Check

1a. 60

b. 30

c. 36

d. 720

Objective A Exercises

3. $\frac{5}{8}-\frac{5}{6}=\frac{15}{24}-\frac{20}{24}$
$=\frac{15}{24}+\frac{(-20)}{24}$
$=\frac{15+(-20)}{24}$
$=-\frac{5}{24}$

5. $-\frac{5}{12}-\frac{3}{8}=\frac{-10}{24}-\frac{9}{24}$
$=\frac{-10}{24}+\frac{(-9)}{24}$
$=\frac{-10+(-9)}{24}=\frac{-19}{24}=-\frac{19}{24}$

7. $-\frac{6}{13}+\frac{17}{26}=\frac{-12}{26}+\frac{17}{26}$
$=\frac{-12+17}{26}=\frac{5}{26}$

9. $-\frac{5}{8}-\left(-\frac{11}{12}\right)=\frac{-15}{24}-\left(\frac{-22}{24}\right)$
$=\frac{-15}{24}+\frac{22}{24}=\frac{-15+22}{24}=\frac{7}{24}$

11. $\frac{5}{12}-\frac{11}{15}=\frac{25}{60}-\frac{44}{60}$
$=\frac{25}{60}+\frac{(-44)}{60}$
$=\frac{25+(-44)}{60}$
$=\frac{-19}{60}=-\frac{19}{60}$

13. $-\frac{3}{4}-\frac{5}{8}=\frac{-6}{8}-\frac{5}{8}$
$=\frac{-6}{8}+\frac{(-5)}{8}$
$=\frac{-6+(-5)}{8}=\frac{-11}{8}=-\frac{11}{8}$

15. $-\frac{5}{2}-\left(-\frac{13}{4}\right)=\frac{-10}{4}-\left(\frac{-13}{4}\right)$
$=\frac{-10}{4}+\frac{13}{4}=\frac{-10+13}{4}=\frac{3}{4}$

17. $-\frac{3}{8}-\frac{5}{12}-\frac{3}{16}=\frac{-18}{48}-\frac{20}{48}-\frac{9}{48}$
$=\frac{-18}{48}+\frac{(-20)}{48}+\frac{(-9)}{48}$
$=\frac{-18+(-20)+(-9)}{48}$
$=\frac{-47}{48}=-\frac{47}{48}$

19. $\frac{1}{2}-\frac{3}{8}-\left(-\frac{1}{4}\right)=\frac{4}{8}-\frac{3}{8}-\left(\frac{-2}{8}\right)$
$=\frac{4}{8}+\frac{(-3)}{8}+\frac{2}{8}$
$=\frac{4+(-3)+2}{8}=\frac{3}{8}$

21. $\frac{1}{3}-\frac{1}{4}-\frac{1}{5}=\frac{20}{60}-\frac{15}{60}-\frac{12}{60}$
$=\frac{20}{60}+\frac{(-15)}{60}+\frac{(-12)}{60}$
$=\frac{20+(-15)+(-12)}{60}$
$=\frac{-7}{60}=-\frac{7}{60}$

23. $\frac{1}{2}+\left(-\frac{3}{8}\right)+\frac{5}{12}=\frac{12}{24}+\frac{(-9)}{24}+\frac{10}{24}$
$=\frac{12+(-9)+10}{24}=\frac{13}{24}$

25. 3.4 + (–6.8) = –3.4

27. –8.32 + (–0.57) = –8.89

29. –4.8 + (–3.2) = –8.0

31. –4.6 + 3.92 = –0.68

33. $-4.2-6.83=-4.2+(-6.83)=-11.03$

35. $18.4-25.2=18.4+(-25.2)=-6.8$

37. –4.5 + 3.2 + (–19.4) = –1.3 + (–19.4) = –20.7

39. $-18.39 + 4.9 - 23.7$
$= -18.39 + 4.9 + (-23.7)$
$= -13.49 + (-23.7)$
$= -37.19$

41. $-3.09 - 4.6 - 27.3$
$= -3.09 + (-4.6) + (-27.3)$
$= -7.69 + (-27.3)$
$= -34.99$

43. $-4.02 + 6.809 - (-3.57) - (-0.419)$
$= -4.02 + 6.809 + 3.57 + 0.419$
$= 2.789 + 3.57 + 0.419$
$= 6.359 + 0.419 = 6.778$

45. $0.27 + (-3.5) - (-0.27) + (-5.44)$
$= 0.27 + (-3.5) + 0.27 + (-5.44)$
$= -3.23 + 0.27 + (-5.44)$
$= -2.96 + (-5.44)$
$= -8.4$

47. Negative

Objective B Exercises

49. $-\frac{2}{9} \times \left(-\frac{3}{14}\right) = \frac{2 \cdot 3}{9 \cdot 14} = \frac{1}{21}$

51. $\left(-\frac{3}{4}\right)\left(-\frac{8}{27}\right) = \frac{3 \cdot 8}{4 \cdot 27} = \frac{2}{9}$

53. $\frac{5}{12}\left(-\frac{8}{15}\right) = -\left(\frac{5 \cdot 8}{12 \cdot 15}\right) = -\frac{2}{9}$

55. $\left(\frac{3}{8}\right)\left(-\frac{15}{41}\right) = -\left(\frac{3 \cdot 15}{8 \cdot 41}\right) = -\frac{45}{328}$

57. $\left(-\frac{5}{7}\right)\left(-\frac{14}{15}\right) = \frac{5 \cdot 14}{7 \cdot 15} = \frac{2}{3}$

59. $\left(-\frac{7}{9}\right)^2 = \left(-\frac{7}{9}\right)\left(-\frac{7}{9}\right) = \frac{7 \cdot 7}{9 \cdot 9} = \frac{49}{81}$

61. $\left(-\frac{4}{5}\right)^3 = \left(-\frac{4}{5}\right)\left(-\frac{4}{5}\right)\left(-\frac{4}{5}\right)$
$= -\frac{4 \cdot 4 \cdot 4}{5 \cdot 5 \cdot 5}$
$= -\frac{64}{125}$

63. $\left(\frac{1}{2}\right)\left(-\frac{3}{4}\right)\left(-\frac{5}{8}\right) = \frac{1 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 8} = \frac{15}{64}$

65. $-\frac{3}{8} \div \frac{7}{8} = -\frac{3}{8} \times \frac{8}{7} = -\frac{3}{7}$

67. $\frac{5}{6} \div \left(-\frac{3}{4}\right) = \frac{5}{6} \times \left(-\frac{4}{3}\right)$
$= -\left(\frac{5 \cdot 4}{6 \cdot 3}\right) = -\frac{10}{9}$

69. $-\frac{5}{16} \div \left(-\frac{3}{8}\right) = -\frac{5}{16} \times -\frac{8}{3} = \frac{5 \cdot 8}{16 \cdot 3} = \frac{5}{6}$

71. $-\frac{8}{19} \div \frac{7}{38} = -\frac{8}{19} \times \frac{38}{7}$
$= -\left(\frac{8 \cdot 38}{19 \cdot 7}\right) = -\frac{16}{7}$

73. $-6 \div \frac{4}{9} = -\frac{6}{1} \times \frac{9}{4}$
$= -\left(\frac{6 \cdot 9}{1 \cdot 4}\right) = -\frac{27}{2}$

75.
$$\begin{array}{r} 8.9 \\ \times\ 3.5 \\ \hline 445 \\ 267 \\ \hline 31.15 \end{array}$$
$-8.9 \times (-3.5) = 8.9 \times 3.5 = 31.15$

77.
$$\begin{array}{r} 14.3 \\ \times\ 7.9 \\ \hline 1287 \\ 1001 \\ \hline 112.97 \end{array}$$
$-14.3 \times 7.9 = -(14.3 \times 7.9) = -112.97$

79. 1.21
$\times$ 0.03
0.0363
$(-1.21)(-0.03) = (1.21)(0.03) = 0.0363$

81.
$$0.8\overline{)77.6}$$
$$\begin{array}{r} 97. \\ 72 \\ \hline 56 \\ -56 \\ \hline 0 \end{array}$$
$-77.6 \div (-0.8) = 77.6 \div 0.8 = 97$

83.
$$3.2\overline{)7.04}$$
$$\begin{array}{r} 2.2 \\ -64 \\ \hline 64 \\ -64 \\ \hline 0 \end{array}$$
$(-7.04) \div (-3.2) = 7.04 \div 3.2 = 2.2$

85.
$$0.8\overline{)3.312}$$
$$\begin{array}{r} 4.14 \\ -32 \\ \hline 11 \\ -8 \\ \hline 32 \\ -32 \\ \hline 0 \end{array}$$
$-3.312 \div (0.8) = -(3.312 \div 0.8) = -4.14$

87.
$$6.9\overline{)26.22}$$
$$\begin{array}{r} 3.8 \\ -207 \\ \hline 552 \\ -552 \\ \hline 0 \end{array}$$
$26.22 \div (-6.9) = -(26.22 \div 6.9) = -3.8$

89. $21.792 \div (-0.96) = -(21.792 \div 0.96) = -22.70$

91. $-3.171 \div (-45.3) = 3.171 \div 45.3 = 0.07$

93. $(-13.97) \div (-25.4) = 13.97 \div 25.4 = 0.55$

95. False

Objective C Exercises

97. **Strategy** To find the amount the temperature fell from 9:00 A.M., subtract the temperature at 9:27 A.M. from the temperature at 9:00 A.M.

Solution $12.22 - (-20) = 32.22$
The temperature fell 32.22°C in 27 min.

99. Greater than

101. **Strategy** To find the difference, subtract the melting point of nitrogen (–209.86°C) from its boiling point (–195.8°C).

Solution
$$\begin{aligned} &-195.8 - (-209.86) \\ &= -195.8 + 209.86 \\ &= 14.06 \end{aligned}$$
The difference between the boiling point of nitrogen and its melting point is 14.06°C.

103a. **Strategy** To find the closing price on the previous day, subtract the change in price (+$.03) from the closing price on June 12, 2012 ($37.94).

Solution $37.94 - 0.03 = 37.91$
The closing price the previous day for General Mills was $37.91.

b. **Strategy** To find the closing price on the previous day, subtract the change in price (–$.44) from the closing price on June 12, 2012 ($19.03).

Solution 19.03 – (-0.44)
= 19.03 + 0.44=19.47
The closing price the previous day for Hillshire Brands was $19.47.

105. Betelguese, Polaris, Vega, Sirius, Sun

107. Strategy To find the distance modulus for Polaris, find its apparent magnitude (1.99) minus its absolute magnitude (–3.2).

Solution $1.99-(-3.2)=1.99+3.2$
$=5.19$
The distance modulus for Polaris is 5.19.

109. Strategy To determine which of the stars is farthest from Earth:

- Find the distance modulus for each star.
- Compare the results and determine the largest distance modulus.

Solution Sun: $-26.8-4.83=-31.63$
Sirius: $-1.47-1.41=-2.88$
Betelguese:
$0.41-(-5.6)=0.41+5.6=6.01$
Vega: $0.04-0.5=-4.5$
Polaris:
$1.99-(-3.2)=1.99+3.2=5.19$
The star that is the farthest from Earth is Betelguese.

Critical Thinking

111. $-\frac{7}{8}<-\frac{5}{6}$

113. $-\frac{3}{4}<-0.7$

Projects or Group Activities

115. Given any two different rational numbers, it is always possible to find a rational number between them. One method is to add the two numbers and divide by 2. Another method is to add the numerators and add the denominators.

For example, given the fractions $\frac{2}{5}$ and $\frac{3}{4}$, $\frac{2+3}{5+4}=\frac{5}{9}$ and $\frac{2}{5}<\frac{5}{9}<\frac{3}{4}$.

Section 10.5

Concept Check

1. Less than 1

3a. No

b. Yes

c. Yes

d. No

Objective A Exercises

5. Since the number is greater than 10, move the decimal point 6 places to the left. The exponent on 10 is 6.
$2{,}370{,}000 = 2.37 \times 10^{6}$

7. Since the number is less than 1, move the decimal point 4 places to the right. The exponent on 10 is –4.
$0.00045 = 4.5 \times 10^{-4}$

9. Since the number is greater than 10, move the decimal point 5 places to the left. The exponent on 10 is 5.
$309{,}000 = 3.09 \times 10^{5}$

11. Since the number is less than 1, move the decimal point 7 places to the right. The exponent on 10 is –7.

$0.000000601 = 6.01 \times 10^{-7}$

13. Since the number is greater than 10, move the decimal point 10 places to the left. The exponent on 10 is 10.

$57{,}000{,}000{,}000 = 5.7 \times 10^{10}$

15. Since the number is less than 1, move the decimal point 8 places to the right. The exponent on 10 is –8.

$0.000000017 = 1.7 \times 10^{-8}$

17. The exponent on 10 is positive. Move the decimal point 5 places to the right.

$7.1 \times 10^{5} = 710{,}000$

19. The exponent on 10 is negative. Move the decimal point 5 places to the left.

$4.3 \times 10^{-5} = 0.000043$

21. The exponent on 10 is positive. Move the decimal point 8 places to the right.

$6.71 \times 10^{8} = 671{,}000{,}000$

23. The exponent on 10 is negative. Move the decimal point 6 places to the left.

$7.13 \times 10^{-6} = 0.00000713$

25. The exponent on 10 is positive. Move the decimal point 12 places to the right.

$5 \times 10^{12} = 5{,}000{,}000{,}000{,}000$

27. The exponent on 10 is negative. Move the decimal point 3 places to the left.

$8.01 \times 10^{-3} = 0.00801$

29. The number is greater than 10. Move the decimal point 10 places to the left. The exponent on 10 is 10.

$16{,}000{,}000{,}000 \text{ mi} = 1.6 \times 10^{10} \text{ mi}$

31a. 580 nanometers

$= 580 \times (1 \times 10^{-9})$ m

$= (580 \times 1) \times 10^{-9}$ m

$= 580 \times 10^{-9}$ m

$= 0.000000580$ m

$= 5.8 \times 10^{-7}$ m

b. 480 nanometers $= 4.80 \times 10^{2}$ nm

33. The number is greater than 10. Move the decimal point 10 places to the left. The exponent on 10 is 10.

$11{,}000{,}000{,}000 = 1.1 \times 10^{10}$

35. The number is less than 1. Move the decimal point 12 places to the right. The exponent on 10 is –12.

$0.000000000001 = 1 \times 10^{-12}$

37. The number is less than 1. Move the decimal point 19 places to the right. The exponent on 10 is –19.

0.00000000000000000016 coulomb

$= 1.6 \times 10^{-19}$ coulomb

Objective B Exercises

39. $8 \div 4 + 2 = 2 + 2 = 4$

41. $4 + (-7) + 3 = -3 + 3 = 0$

43. $4^2 - 4 = 16 - 4 = 16 + (-4) = 12$

45.
$$\begin{aligned} 2(3 - 5) - 2 &= 2\left[3 + (-5)\right] - 2 \\ &= 2(-2) - 2 \\ &= -4 - 2 \\ &= -4 + (-2) = -6 \end{aligned}$$

47. $4 - (-3)^2 = 4 - 9 = 4 + (-9) = -5$

49.
$$\begin{aligned} 4 - (-3) - 5 &= 4 + 3 + (-5) \\ &= 7 + (-5) = 2 \end{aligned}$$

51. $4-(-2)^2+(-3)=4-4+(-3)$
$=4+(-4)+(-3)$
$=0+(-3)=-3$

53. $3^2-4\cdot 2=9-4\cdot 2$
$=9-8=9+(-8)=1$

55. $3\times(6-2)\div 6=3\times\left[6+(-2)\right]\div 6$
$=3\times 4\div 6=12\div 6=2$

57. $2^2-(-3)^2+2=4-9+2$
$=4+(-9)+2$
$=-5+2=-3$

59. $6-2(1-5)=6-2\left[1+(-5)\right]$
$=6-2(-4)$
$=6-(-8)=6+8=14$

61. $(-2)^2-(-3)^2+1=4-9+1$
$=4+(-9)+1$
$=-5+1=-4$

63. $6-(-3)(-3)^2=6-(-3)9$
$=6-(-27)$
$=6+27=33$

65. $4\cdot 2-3\cdot 7=8-3\cdot 7$
$=8-21=8+(-21)=-13$

67. $(-2)^2-5\cdot 3-1=4-5\cdot 3-1$
$=4-15-1$
$=4+(-15)+(-1)$
$=-11+(-1)=-12$

69. $7(6)-5(6)+3(2)-2+1$
$=42-5(6)+3(2)-2+1$
$=42-30+3(2)-2+1$
$=42-30+6-2+1$
$=42+(-30)+6+(-2)+1$
$=12+6+(-2)+1$
$=18+(-2)+1$
$=16+1=17$

71. $-4(3)(-2)+12(3-4)+(-12)$
$=-4(3)(-2)+12\left[3+(-4)\right]+(-12)$
$=-4(3)(-2)+12(-1)+(-12)$
$=-12(-2)+12(-1)+(-12)$
$=24+12(-1)+(-12)$
$=24+(-12)+(-12)$
$=12+(-12)=0$

73. $-12\cdot(6-8)+1^2\cdot 3^2\cdot 2-6\cdot 2$
$=-12\cdot\left[6+(-8)\right]+1^2\cdot 3^2\cdot 2-6\cdot 2$
$=-12\cdot(-2)+1^2\cdot 3^2\cdot 2-6\cdot 2$
$=-12\cdot(-2)+1\cdot 9\cdot 2-6\cdot 2$
$=24+1\cdot 9\cdot 2-6\cdot 2$
$=24+18-6\cdot 2$
$=24+18-2$
$=24+18+(-12)$
$=42+(-12)=30$

75. $10\cdot 9-(8+7)\div 5+6-7+8$
$=10\cdot 9-15\div 5+6-7+8$
$=90-15\div 5+6-7+8$
$=90-3+6-7+8$
$=90+(-3)+6+(-7)+8$
$=87+6+(-7)+8$
$=93+(-7)+8$
$=86+8=94$

77. $3^2(4-7)\div 9+6-3-4(2)$

$=3^2\left[4+(-7)\right]\div 9+6-3-4(2)$

$=3^2(-3)\div 9+6-3-4(2)$

$=9(-3)\div 9+6-3-4(2)$

$=-27\div 9+6-3-4(2)$

$=-3+6-3-4(2)$

$=-3+6-3-8$

$=-3+6+(-3)+(-8)$

$=3+(-3)+(-8)$

$=0+(-8)=-8$

79. $(-3)^2\cdot(5-7)^2-(-9)\div 3$

$=(-3)^2\cdot\left[5+(-7)\right]^2-(-9)\div 3$

$=(-3)^2\cdot(-2)^2-(-9)\div 3$

$=9\cdot 4-(-9)\div 3$

$=36-(-9\div 3)$

$=36-(-3)$

$=36+3=39$

81. $4-6(2-5)^3\div(17-8)$

$=4-6\left[2+(-5)\right]^3\div\left[17+(-8)\right]$

$=4-6(-3)^3\div 9$

$=4-6(-27)\div 9$

$=4-(-162)\div 9$

$=4-(-18)=4+8=22$

83. $(1.2)^2-4.1\cdot 0.3=1.44-4.1\cdot 0.3$

$=1.44-1.23$

$=1.44+(-1.23)=0.21$

85. $1.6-(-1.6)^2=1.6-2.56$

$=1.6+(-2.56)=-0.96$

87. $(4.1-3.9)-0.7^2=\left[4.1+(-3.9)\right]-0.7^2$

$=0.2-0.7^2$

$=0.2-0.49$

$=0.2+(-0.49)=-0.29$

89. $(-0.4)^2 1.5-2=0.16(1.5)-2$

$=0.24-2$

$=0.24+(-2)=-1.76$

91. $4.2-(-3.9)-6=4.2+3.9+(-6)$

$=8.1+(-6)=2.1$

93. $\left(\frac{3}{4}\right)^2-\frac{3}{8}=\frac{9}{16}-\frac{3}{8}$

$=\frac{9}{16}-\frac{6}{16}=\frac{3}{16}$

95. $\frac{5}{16}-\frac{3}{8}+\frac{1}{2}=\frac{5}{16}-\frac{6}{16}+\frac{1}{2}$

$=\frac{5}{16}+\left(-\frac{6}{16}\right)+\frac{1}{2}$

$=-\frac{1}{16}+\frac{1}{2}=-\frac{1}{16}+\frac{8}{16}=\frac{7}{16}$

97. $\frac{1}{2}\cdot\frac{1}{4}\cdot\frac{1}{2}-\frac{3}{8}=\frac{1}{8}\cdot\frac{1}{2}-\frac{3}{8}$

$=\frac{1}{16}-\frac{3}{8}$

$=\frac{1}{16}+\left(-\frac{3}{8}\right)$

$=\frac{1}{16}+\left(-\frac{6}{16}\right)=-\frac{5}{16}$

99. $\frac{1}{2}-\left(\frac{3}{4}-\frac{3}{8}\right)\div\frac{1}{3}=\frac{1}{2}-\left(\frac{6}{8}-\frac{3}{8}\right)\div\frac{1}{3}$

$=\frac{1}{2}-\frac{3}{8}\div\frac{1}{3}=\frac{1}{2}-\frac{3}{8}\times\frac{3}{1}$

$=\frac{1}{2}-\frac{9}{8}=\frac{4}{8}+\left(-\frac{9}{8}\right)=-\frac{5}{8}$

101. (i)

Critical Thinking

103a. $3.45 \times 10^{-14} > 3.45 \times 10^{-15}$

b. $5.23 \times 10^{18} > 5.23 \times 10^{17}$

c. $3.12 \times 10^{12} > 3.12 \times 10^{11}$

105a. $1^3 + 2^3 + 3^3 + 4^3 = 1 + 8 + 27 + 64 = 100$

b. $(-1)^3 + (-2)^3 + (-3)^3 + (-4)^3$
$= -1 + (-8) + (-27) + (-64)$
$= -100$

c. $1^3 + 2^3 + 3^3 + 4^3 + 5^3$
$= 1 + 8 + 27 + 64 + 125$
$= 225$

d. $(-1)^3 + (-2)^3 + (-3)^3 + (-4)^3 + (-5)^3 = -225$

Projects or Group Activities

107a. $2^{(3^2)} = 2^9 = 512$
$(2^3)^2 = 8^2 = 64$

No, the answers are not the same.

b. $2^{(3^2)}$

c. Answers will vary.

Chapter 10 Review Exercises

1. –22

2. $-8 - (-2) - (-10) - 3 = -8 + 2 + 10 - 3$
$= -6 + 10 - 3$
$= 4 - 3 = 1$

3. $\frac{5}{8} - \frac{5}{6} = \frac{15}{24} - \frac{20}{24}$
$= \frac{15}{24} + \frac{(-20)}{24}$
$= \frac{15 + (-20)}{24}$
$= \frac{-5}{24} = -\frac{5}{24}$

4. $-0.33 + 1.98 - 1.44 = -0.33 + 1.98 + (-1.44)$
$= 1.65 + (-1.44) = 0.21$

5. $\left(-\frac{2}{3}\right)\left(\frac{6}{11}\right)\left(-\frac{22}{25}\right) = \frac{2 \cdot 6 \cdot 22}{3 \cdot 11 \cdot 25} = \frac{8}{25}$

6. $\begin{array}{r} 16 \\ \times\ .08 \\ \hline 1.28 \end{array}$
$-0.08 \times 16 = -(0.08 \times 16) = -1.28$

7. $12 - 6 \div 3 = 12 - 2 = 12 + (-2) = 10$

8. $\left(\frac{2}{3}\right)^2 - \frac{5}{6} = \left(\frac{2}{3} \cdot \frac{2}{3}\right) - \frac{5}{6}$
$= \frac{4}{9} - \frac{5}{6} = \frac{8}{18} - \frac{15}{18}$
$= \frac{8}{18} + \left(-\frac{15}{18}\right) = \frac{8 + (-15)}{18} = -\frac{7}{18}$

9. 4

10. $0 > -3$

11. $-|-6| = -6$

12. $-18 \div (-3) = 18 \div 3 = 6$

13. $-\frac{3}{8} + \frac{5}{12} + \frac{2}{3} = \frac{-9}{24} + \frac{10}{24} + \frac{16}{24}$
$= \frac{-9 + 10 + 16}{24} = \frac{17}{24}$

14. $\frac{1}{3} \cdot \left(-\frac{3}{4}\right) = -\left(\frac{1}{3} \cdot \frac{3}{4}\right) = -\frac{1}{4}$

15. $-\frac{7}{12}\div\left(-\frac{14}{39}\right)=-\frac{7}{12}\times\left(-\frac{39}{14}\right)$
$=\frac{7\cdot 39}{12\cdot 14}=\frac{13}{8}$

16. $16\div 4(8-2)=16\div 4\left[8+(-2)\right]$
$=16\div 4(6)=4(6)=24$

17. $-22+14+(-18)=-8+(-18)=-26$

18. $3^2-9+2=9-9+2$
$=9+(-9)+2$
$=0+2=2$

19. The number is less than 1. Move the decimal point 5 places to the right. The exponent on 10 is –5.

$0.0000397 = 3.97\times 10^{-5}$

20.

$$\begin{array}{r} 0.08 \\ 18.3\overline{)1.4.64} \\ \underline{-1464} \\ 0 \end{array}$$

$-1.464\div 18.3=-(1.464\div 18.3)=-0.08$

21. $-\frac{5}{12}+\frac{7}{9}-\frac{1}{3}=\frac{-15}{36}+\frac{28}{36}-\frac{12}{36}$
$=\frac{-15}{36}+\frac{28}{36}+\frac{(-12)}{36}$
$=\frac{-15+28+(-12)}{36}=\frac{1}{36}$

22. $\frac{6}{34}\left(\frac{17}{40}\right)=\frac{6\cdot 17}{34\cdot 40}=\frac{3}{40}$

23.

$$\begin{array}{r} 0.035 \\ \times\ 1.2 \\ \hline 70 \\ \underline{35\ \ } \\ 0.042 \end{array}$$

$1.2\times(-0.035)=-(1.2\times 0.035)=-0.042$

24. $-\frac{1}{2}+\frac{3}{8}\div\frac{9}{20}=-\frac{1}{2}+\frac{3}{8}\times\frac{20}{9}$
$=-\frac{1}{2}+\frac{3\cdot 20}{8\cdot 9}$
$=-\frac{1}{2}+\frac{5}{6}=-\frac{3}{6}+\frac{5}{6}=\frac{2}{6}=\frac{1}{3}$

25. $|-5| = 5$

26. $-2 > -40$

27. $2\times(-13)=-(2\times 13)=-26$

28. $-0.4(5)-(-3.33)=-2-(-3.33)$
$=-2+3.33=1.33$

29. $\frac{5}{12}+\left(-\frac{2}{3}\right)=\frac{5}{12}+\frac{(-8)}{12}$
$=\frac{5+(-8)}{12}=\frac{-3}{12}=\frac{-1}{4}=-\frac{1}{4}$

30. $-33.4+9.8-(-16.2)=-33.4+9.8+16.2$
$=-23.6+16.2=-7.4$

31. $\left(-\frac{3}{8}\right)\div\left(-\frac{4}{5}\right)=-\frac{3}{8}\times\left(-\frac{5}{4}\right)=\frac{3\cdot 5}{8\cdot 4}=\frac{15}{32}$

32. The exponent on 10 is positive. Move the decimal point 5 places to the right.

$2.4\times 10^5 = 240{,}000$

33. **Strategy** To find the temperature, add the increase (18°) to the original temperature (–22°).

Solution $-22+18=-4$
The temperature is –4°.

34. **Strategy** To find the student's score:
• Multiply the number of questions answered correctly (38) by 3. Multiply the number of questions left blank (8) by –1. Multiply the number of questions

answered incorrectly (4) by –2.

• Add the three products.

Solution $38 \times 3 = 114$

$8 \times (-1) = -8$

$4 \times (-2) = -8$

$114 + (-8) + (-8)$

$= 106 + (-8)$

$= 98$

The student's score was 98.

35. Strategy To find the difference between the boiling point and the melting point of mercury, subtract the melting point (–38.87°C) from the boiling point (356.58°C).

Solution 356.58 – (–38.87)

= 356.58 + 38.87 = 395.45

The difference between the boiling and melting points is 395.45°C.

Chapter 10 Test

1. –5 – (–8) = –5 + 8 = 3

2. $-|-2| = -2$

3. $-\frac{2}{5} + \frac{7}{15} = \frac{-6}{15} + \frac{7}{15} = \frac{-6+7}{15} = \frac{1}{15}$

4.
$$\begin{array}{r} 0.032 \\ \times 1.9 \\ \hline 288 \\ 32 \\ \hline 0.0608 \end{array}$$

$0.032 \times (-1.9) = -(0.032 \times 1.9) = -0.0608$

5. –8 > –10

6. 1.22 + (–3.1) = –1.88

7. $4(4-7) \div (-2) - 4(8)$

$= 4[4 + (-7)] \div (-2) - 4(8)$

$= 4(-3) \div (-2) - 4(8)$

$= -12 \div (-2) - 4(8)$

$= 6 - 4(8)$

$= 6 - 32$

$= 6 + (-32) = -26$

8. –5 × (–6) × 3 = 30 × 3 = 90

9. –1.004 – 3.01 = –1.004 + (–3.01) = –4.014

10. –72 ÷ 8 = – (72 ÷ 8) = –9

11. –2 + 3 + (–8) = 1 + (–8) = –7

12. $-\frac{3}{8} + \frac{2}{3} = \frac{-9}{24} + \frac{16}{24} = \frac{-9+16}{24} = \frac{7}{24}$

13. The number is greater than 10. Move the decimal point 10 places to the left. The exponent on 10 is 10.

$87{,}600{,}000{,}000 = 8.76 \times 10^{10}$

14. –4 × 12 = –(4 × 12) = –48

15. $\frac{0}{-17} = 0$

16. $16 - 4 - (-5) - 7 = 16 + (-4) + 5 + (-7)$

$= 12 + 5 + (-7)$

$= 17 + (-7) = 10$

17. $-\frac{2}{3} \div \frac{5}{6} = -\frac{2}{3} \times \frac{6}{5} = -\left(\frac{2 \cdot 6}{3 \cdot 5}\right) = -\frac{4}{5}$

18. 0 > –4

19. 16 + (–10) + (–20) = 6 + (–20) = –14

20. $(-2)^2 - (-3)^2 \div (1-4)^2(2) - 6$
$= (-2)^2 - (-3)^2 \div [1+(-4)]^2(2) - 6$
$= (-2)^2 - (-3)^2 \div (-3)^2(2) - 6$
$= 4 - 9 \div 9(2) - 6$
$= 4 - 1(2) - 6$
$= 4 - 2 - 6$
$= 4 + (-2) + (-6)$
$= 2 + (-6) = -4$

21. $-\frac{2}{5} - \left(\frac{-7}{10}\right) = \frac{-4}{10} - \left(-\frac{7}{10}\right)$
$= \frac{-4}{10} + \frac{7}{10} = \frac{-4+7}{10} = \frac{3}{10}$

22. The exponent on 10 is negative. Move the decimal point 8 places to the left.

$9.601 \times 10^{-8} = 0.00000009601$

23.
$$4.6\overline{)15.64}\quad 3.4$$
$$\underline{-138}$$
$$184$$
$$\underline{-184}$$
$$0$$
$-15.64 \div (-4.6) = (15.64 \div 4.6) = 3.4$

24. $-\frac{1}{2} + \frac{1}{3} + \frac{1}{4} = \frac{-6}{12} + \frac{4}{12} + \frac{3}{12}$
$= \frac{-6+4+3}{12} = \frac{1}{12}$

25. $\frac{3}{8}\left(-\frac{5}{6}\right)\left(-\frac{4}{15}\right) = \frac{3}{8}\left(\frac{5}{6}\right)\left(\frac{4}{15}\right)$
$= \frac{3 \cdot 5 \cdot 4}{8 \cdot 6 \cdot 15} = \frac{1}{12}$

26. $2.113 - (-1.1) = 2.113 + 1.1 = 3.213$

27. **Strategy** To find the temperature, add the increase (11°C) to the previous temperature (–4°C).

Solution $-4 + 11 = 7$
The temperature is 7°C.

28. **Strategy** To find the melting point of oxygen, multiply the melting point of radon (–71°C) by 3.

Solution $-71 \times 3 = -213$
The melting point of oxygen is –213°C.

29. **Strategy** To find the amount the temperature fell, subtract the temperature at midnight (–29.4°C) from the temperature at noon (17.22°C).

Solution $17.22 - (-29.4)$
$= 17.22 + 29.4 = 46.62$
The temperature fell 46.62°C.

30. **Strategy** To find the average daily low temperature:
• Add the three temperature readings.
• Divide by 3.

Solution $-7 + 9 + (-8) = 2 + (-8) = -6$
$-6 \div 3 = -2$
The average low temperature was –2°F.

Cumulative Review Exercises

1. $16 - 4 \cdot (3-2)^2 \cdot 4 = 16 - 4 \cdot (1)^2 \cdot 4$
$= 16 - 4 \cdot (1) \cdot 4 = 16 - 16 = 0$

2. $8\frac{1}{2} = 8\frac{7}{14} = 7\frac{21}{14}$
$-3\frac{4}{7} = 3\frac{8}{14} = 3\frac{8}{14}$
$4\frac{13}{14}$

3. $3\frac{7}{8} \div 1\frac{1}{2} = \frac{31}{8} \div \frac{3}{2}$
$= \frac{31}{8} \times \frac{2}{3}$
$= \frac{31}{12} = 2\frac{7}{12}$

4. $\frac{3}{8} \div \left(\frac{3}{8} - \frac{1}{4}\right) \div \frac{7}{3}$

$= \frac{3}{8} \div \left(\frac{3}{8} - \frac{2}{8}\right) \div \frac{7}{3}$

$= \frac{3}{8} \div \left(\frac{1}{8}\right) \div \frac{7}{3} = \frac{3}{8} \times \frac{8}{1} \div \frac{7}{3}$

$= 3 \div \frac{7}{3} = 3 \times \frac{3}{7} = \frac{3 \cdot 3}{7}$

$= \frac{9}{7} = 1\frac{2}{7}$

5. $\begin{array}{r} 2.90700 \\ \underline{-1.09761} \\ 1.80939 \end{array}$

6. $\frac{7}{12} = \frac{n}{32}$

$7 \cdot 32 = 12 \times n$

$224 = 12 \times n$

$224 \div 12 = n$

$18.67 \approx n$

7. $160\% \times n = 22$

$1.6 \times n = 22$

$n = 22 \div 1.6$

$n = 13.75$

8. $\begin{array}{r} 1 \text{ gal } 3 \text{ qt} \\ 4\overline{)7} \\ \underline{-4} \\ 3 \end{array}$

9. 6692 ml = 6.692 L

10. $4.2 \text{ ft} = 4.2 \text{ } \cancel{\text{ft}} \times \frac{1 \text{ m}}{3.28 \text{ } \cancel{\text{ft}}} = \frac{4.2}{3.28} \text{m} \approx 1.28 \text{ m}$

11. Percent × base = amount

$0.32 \times 180 = n$

$57.6 = n$

12. $3\frac{2}{5} \times 100\% = \frac{1700}{5}\% = 340\%$

13. $-8 + 5 = -3$

14. $3\frac{1}{4} + \left(-6\frac{5}{8}\right) = \frac{13}{4} + \left(\frac{-53}{8}\right) = \frac{26}{8} + \frac{(-53)}{8}$

$= \frac{26 + (-53)}{8} = \frac{-27}{8} = -\frac{27}{8}$

15. $-6\frac{1}{8} - 4\frac{5}{12} = \frac{-49}{8} - \frac{-53}{12}$

$= \frac{-147}{24} - \frac{106}{24}$

$= \frac{-147}{24} + \frac{(-106)}{24}$

$= \frac{-147 + (-106)}{24}$

$= \frac{-253}{24} = -\frac{253}{24}$

16. $-12 - (-7) - 3(-8)$

$= -12 + 7 + 24 = -5 + 24 = 19$

17. $\begin{array}{r} 1.09 \\ \times 3.2 \\ \hline 218 \\ \underline{327} \\ 3.488 \end{array}$

$-3.2 \times -1.09 = 3.2 \times 1.09 = 3.488$

18. $-6 \cdot 7 \cdot \left(-\frac{3}{4}\right) = 6 \cdot 7 \cdot \frac{3}{4}$

$= \frac{6 \cdot 7 \cdot 3}{4} = \frac{126}{4} = \frac{63}{2}$

19. $42 \div (-6) = -(42 \div 6) = -7$

20. $-2\frac{1}{7} \div \left(3\frac{3}{5}\right) = \frac{15}{7} \div \left(\frac{18}{5}\right)$

$= \frac{15}{7} \times \left(\frac{5}{18}\right) = \frac{25}{42}$

21. $3(3 - 7) \div 6 - 2 = 3\left[3 + (-7)\right] \div 6 - 2$

$= 3(-4) \div 6 - 2$

$= -12 \div 6 - 2$

$= -2 + (-2) = -4$

22. $4-(-2)^2 \div (1-2)^2(3)+4$
$= 4-(-2)^2 \div \left[1+(2-2)\right]^2(3)+4$
$= 4-(-2)^2 \div (-1)^2(3)+4$
$= 4-4 \div 1(3)+4$
$= 4-4(3)+4$
$= 4-12+4$
$= 4+(-12)+4$
$= -8+4 = -4$

23. **Strategy** To find the length of the remaining board, subtract the length cut $\left(5\frac{2}{3}\text{ ft}\right)$ from the original length (8 ft).

Solution
$$\begin{array}{r} 8 \text{ ft} = 7\frac{3}{3}\text{ ft} \\ -5\frac{2}{3}\text{ ft} = 5\frac{2}{3}\text{ ft} \\ \hline 2\frac{1}{3}\text{ ft} \end{array}$$

The length remaining is $2\frac{1}{3}$ ft.

24. **Strategy** To find Nimisha's new balance:
• Subtract the amounts of the checks written.
• Add the amount of the deposit.

Solution
$$\begin{array}{r} 763.56 \\ -\ 135.88 \\ \hline 627.68 \\ -47.81 \\ \hline 579.87 \\ +\ 223.44 \\ \hline 803.31 \end{array}$$

Nimisha's new balance is $803.31.

25. **Strategy** To find the percent:
• Subtract the sale price ($120) from the original price ($165) to find the amount of the decrease.
• Solve the basic percent equation for percent. The base is $165 and the amount is the amount of the decrease.

Solution $165 - 120 = 45$
Percent × base = amount
$n \times 165 = 45$
$n = 45 \div 165$
$n \approx 0.273 = 27.3\%$

The percent decrease is 27.3%.

26. **Strategy** To find how many gallons of coffee must be prepared:
• Multiply the number of guests (80) by the amount of coffee each guest is expected to drink (2 c) to find the number of cups of coffee to prepare.
• Convert cups to gallons.

Solution $80 \times 2 \text{ c} = 160 \text{ c}$
$$160 \text{ c} = 160 \cancel{\text{ c}} \times \frac{1 \cancel{\text{pt}}}{2 \cancel{\text{ c}}} \times \frac{1 \cancel{\text{ qt}}}{2 \cancel{\text{ pt}}} \times \frac{1 \text{ gal}}{4 \cancel{\text{ qt}}}$$
$$= \frac{160}{16} \text{ gal} = 10 \text{ gal}$$

The amount of coffee that should be prepared is 10 gal.

27. **Strategy** To find the dividend per share:
• Solve the basic percent equation for amount to find the amount of the increase. The base amount is $1.50 and the percent is 12%.
• Add the amount of the increase to the dividend ($1.50).

Solution

$$12\% \times 1.50 = n$$
$$0.12 \times 1.50 = n$$
$$0.18 = n$$

$$\begin{array}{r} 1.50 \\ +0.18 \\ \hline 1.68 \end{array}$$

The dividend per share after the increase was \$1.68.

28a. Strategy To find the number of households:

- Locate the sector of the graph that represents once a week and read the percent.
- Write and solve the basic percent equation using n to represent the number of households that have a family night once a week. The percent is from the graph and the base is 118 million.

Solution The percent is 6%.

$$\text{Percent} \times \text{base} = \text{amount}$$
$$6\% \times 118{,}000{,}000 = n$$
$$0.06 \times 118{,}000{,}000 = n$$
$$7{,}080{,}000 = n$$

7.08 million households have a family night once a week.

b. Strategy To find the fraction of U.S. households:

- Locate the sector of the graph that represents rarely or never and read the percent.
- Convert the percent to a fraction.

Solution The percent is 24%.

$$24\% = 24 \times \frac{1}{100}$$
$$= \frac{24}{1} \times \frac{1}{100}$$
$$= \frac{24}{100} = \frac{6}{25}$$

$\frac{6}{25}$ of U.S. households rarely or never have a family night.

c. Strategy To determine if the number is more or less:

- Locate the sectors of the graph that represent once a month and once a week and read the percents.
- Multiply the percent that represents once a week by 3.
- Compare the result to the percent that represents once a month.

Solution Once a month: 21%

Once a week: 6%

$6\% \times 3 = 18\%$

$21\% > 18\%$

The number of households that have a family night only once a month is more than three times the number of households that have family night once a week.

29. **Strategy** To find the number of voters, write and solve a proportion.

Solution

$$\frac{5}{8} = \frac{n}{960{,}000}$$

$$5 \times 960{,}000 = 8 \times n$$

$$4{,}800{,}000 = 8 \times n$$

$$4{,}800{,}000 \div 8 = n$$

$$600{,}000 = n$$

600,000 people would vote.

30. **Strategy** To find the average high temperature, add the daily high temperatures (–19°, –7°, 1°, and 9°) and divide that sum by the number of temperatures (4).

Solution

$$(-19) + (-7) + (1) + (9)$$

$$= -26 + 1 + 9$$

$$= -25 + 9$$

$$= -16$$

$$-16 \div 4 = -4$$

The average high temperature is –4°.

Chapter 11: Introduction to Algebra

Prep Test

1. $2-9=-7$

2. $-5(4)=-20$

3. $-16+16=0$

4. $\dfrac{-7}{-7}=1$

5. $-\dfrac{3}{8}\left(-\dfrac{8}{3}\right)=1$

6. $\left(\dfrac{3}{5}\right)^3\left(\dfrac{5}{9}\right)^2=\dfrac{3}{5}\cdot\dfrac{3}{5}\cdot\dfrac{3}{5}\cdot\dfrac{5}{9}\cdot\dfrac{5}{9}$

$=\dfrac{\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{5}}\cdot\overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}}\cdot\underset{1}{\cancel{5}}\cdot 5\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot\underset{1}{\cancel{3}}\cdot 3}$.

$=\dfrac{1}{15}$

7. $\dfrac{2}{3}+\left(\dfrac{3}{4}\right)^2\cdot\dfrac{2}{9}=\dfrac{2}{3}+\dfrac{9}{16}\cdot\dfrac{2}{9}$

$=\dfrac{2}{3}+\dfrac{1}{8}$

$=\dfrac{16}{24}+\dfrac{3}{24}$

$=\dfrac{19}{24}$

8. $-8\div(-2)^2+6=-8\div 4+6$

$=-2+6$

$=4$

9. $4+5(2-7)^2\div(-8+3)$

$=4+5(-5)^2\div(-5)$

$=4+5(25)\div(-5)$

$=4+125\div(-5)$

$=4+(-25)=-21$

Section 11.1

Concept Check

1. Commutative Property of Addition

3. Distributive Property

5. Distributive Property

7. Commutative Property of Addition

Objective A Exercises

9. $5a-3b=5(-3)-3(6)$

$=-15-18$

$=-15+(-18)$

$=-33$

11. $2a+3c=2(-3)+3(-2)$

$=-6+(-6)=-12$

13. $-c^2=-(-2)^2=-4$

15. $b-a^2=6-(-3)^2=6-9=6+(-9)=-3$

17. $ab-c^2=(-3)(6)-(-2)^2$

$=-18-4$

$=-18+(-4)=-22$

19. $2ab+c^2=2(-3)6+(-2)^2$

$=-36+4$

$=-32$

21. $-4a^2+4b+3c=-4(-3)^2+4(6)+3(-2)$

$=-4(9)+4(6)+3(-2)$

$=-36+24+(-6)$

$=-12+(-6)$

$=-18$

23. $3a+5b^2+5c=9(-3)+5(6)^2+5(-2)$

$=3(-3)+5(36)+5(-2)$

$=-9+180+(-10)$

$=171+(-10)$

$=161$

25. $3ab^2 - 4c = 3(-3)(6)^2 - 4(-2)$
$= 3(-3)(36) - 4(-2)$
$= -324 - (-8)$
$= -324 + 8$
$= -316$

27. $2ab^2 + 2bc = 2(-3)(6)^2 + 2(6)(-2)$
$= 2(-3)(36) + 2(6)(-2)$
$= -216 + (-24)$
$= -240$

29. $\dfrac{2a-b}{3c+2a} = \dfrac{2(-3)-6}{3(-2)+2(-3)}$
$= \dfrac{-6+(-6)}{-6+(-6)}$
$= \dfrac{-12}{-12}$
$= 1$

31. $3(2a-b)+c^2 = 3\left[2(-3)-6\right]+(-2)^2$
$= 3\left[-6+(-6)\right]+4$
$= 3(-12)+4$
$= -36+4$
$= -32$

33. $2b-\left(3c+a^2\right) = 2(6)-\left[3(-2)+(-3)^2\right]$
$= 2(6)-\left[3(-2)+9\right]$
$= 2(6)-(-6+9)$
$= 2(6)-3$
$= 12-3$
$= 12+(-3) = 9$

35. $\dfrac{1}{3}a+\left(\dfrac{1}{2}b-\dfrac{2}{3}a\right)$
$= \dfrac{1}{3}(-3)+\left[\dfrac{1}{2}\cdot 6-\dfrac{2}{3}(-3)\right]$
$= \dfrac{1}{3}(-3)+\left[3-(-2)\right]$
$= \dfrac{1}{3}(-3)+(3+2) = -1+5 = 4$

37. $\dfrac{1}{6}b+\dfrac{1}{3}(c+a) = \dfrac{1}{6}\cdot 6+\dfrac{1}{3}\left[-2+(-3)\right]$
$= \dfrac{1}{6}\cdot 6+\dfrac{1}{3}(-5)$
$= 1+\left(-\dfrac{5}{3}\right) = \dfrac{3}{3}+\left(-\dfrac{5}{3}\right)$
$= -\dfrac{2}{3}$

39a. **Strategy** To find the total cost to purchase 120 pairs of shorts, substitute 120 for n in the expression $22n$ and simplify.

Solution $22n = 22(120) = 2640$

The total cost is \$2640.

b. **Strategy** To find the total cost to purchase 120 pairs of shorts, substitute 250 for n in the expression $22n$ and simplify.

Solution $22n = 22(250) = 5500$

The total cost is \$5500.

41. **Strategy** To find the corresponding Fahrenheit temperature, substitute each value given in the table for C in the expression $\dfrac{9}{5}C+32$ and simplify.

Solution

$$\frac{9}{5}C+32=\frac{9}{5}(0)+32$$
$$=0+32$$
$$=32;32°\text{F}$$
$$\frac{9}{5}C+32=\frac{9}{5}(100)+32$$
$$=180+32$$
$$=212;212°\text{F}$$
$$\frac{9}{5}C+32=\frac{9}{5}(25)+32$$
$$=45+32$$
$$=77;77°\text{F}$$

43. Positive

45. Positive

Objective B Exercises

47. $2x^2$, $3x$, $\underline{-4}$

49. $3a^2$, $-4a$, $\underline{8}$

51. $\underline{3}x^2$, $\underline{-4}x$

53. $\underline{1}y^2$, $\underline{6}a$

55. (ii), (iii)

57. $7z+9z=16z$

59. $12m-3m=12m+(-3)m=9m$

61. $5at+7at=12at$

63. $-4yt+7yt=3yt$

65. $-3x-12y$; Unlike terms

67. $3t^2-5t^2=3t^2+(-5)t^2=-2t^2$

69. $6c-5+7c=6c+7c-5=13c-5$

71. $2t+3t-7t=2t+3t+(-7)t$

$$=5t+(-7)t=-2t$$

73. $7y^2-2-4y^2=7y^2+(-2)+(-4)y^2$
$$=7y^2+(-4)y^2+(-2)$$
$$=3y^2-2$$

75. $6w-8u+8w=6w+(-8)u+8w$
$$=6w+8w+(-8)u$$
$$=14w-8u$$

77. $10-11xy-12xy=10+(-11)xy+(-12)xy$
$$=10+(-23)xy$$
$$=10-23xy=-23xy+10$$

79. $3v^2-6v^2-8v^2=3v^2+(-6)v^2+(-8)v^2$
$$=-3v^2+(-8)v^2$$
$$=-11v^2$$

81. $-10ab-3a+2ab=-10ab+2ab-3a$
$$=-8ab-3a$$

83. $-3y^2-y+7y^2=-3y^2+7y^2-y$
$$=4y^2-y$$

85. $2a-3b^2-5a+b^2$
$=2a+(-3)b^2+(-5)a+b^2$
$=2a+(-5)a+(-3)b^2+b^2$
$=-3a-2b^2$

87. $3x^2-7x+4x^2-x$
$=3x^2+(-7)x+4x^2+(-1)x$
$=3x^2+4x^2+(-7)x+(-1)x$
$=7x^2-8x$

89. $6s-t-9s+7t=6s+(-1)t+(-9)s+7t$
$$=6s+(-9)s+(-1)t+7t$$
$$=-3s+6t$$

91. $4m+8n-7m+2n=4m+8n+(-7)m+2n$
$$=4m+(-7)m+8n+2n$$
$$=-3m+10n$$

93. $-5ab+7ac+10ab-3ac$
$=-5ab+7ac+10ab+(-3)ac$
$=-5ab+10ab+7ac+(-3)ac$
$=5ab+4ac$

95. $\frac{4}{9}a^2 - \frac{1}{5}b^2 + \frac{2}{9}a^2 + \frac{4}{5}b^2$

$= \frac{4}{9}a^2 + \left(-\frac{1}{5}\right)b^2 + \frac{2}{9}a^2 + \frac{4}{5}b^2$

$= \frac{4}{9}a^2 + \frac{2}{9}a^2 + \left(-\frac{1}{5}\right)b^2 + \frac{4}{5}b^2$

$= \frac{6}{9}a^2 + \frac{3}{5}b^2$

$= \frac{2}{3}a^2 + \frac{3}{5}b^2$

97. $7.81m + 3.42n - 6.25m - 7.19n$

$= 7.81m + 3.42n + (-6.25)m + (-7.19)n$

$= 7.81m + (-6.25)m + 3.42n + (-7.19)n$

$= 1.56m - 3.77n$

Objective C Exercises

99. (ii), (iii)

101. $5(x + 4) = 5x + 5 \cdot 4 = 5x + 20$

103. $(y - 3)4 = [y + (-3)]4$

$= y \cdot 4 + (-3)4$

$= 4y + (-12)$

$= 4y - 12$

105. $-2(a + 4) = -2(a) + (-2)(4)$

$= -2a + (-8)$

$= -2a - 8$

107. $3(5x + 10) = 3(5x) + 3(10) = 15x + 30$

109. $5(3c - 5) = 5[3c + (-5)]$

$= 5(3c) + 5(-5)$

$= 15c + (-25)$

$= 15c - 25$

111. $-3(y - 6) = -3[y + (-6)]$

$= -3y + (-3)(-6)$

$= -3y + 18$

113. $5x + 2(x + 7) = 5x + 2x + 2(7)$

$= 7x + 14$

115. $8y - 4(y + 2) = 8y + (-4)(y + 2)$

$= 8y + (-4)y + (-4)(2)$

$= 8y + (-4y) + (-8)$

$= 4y - 8$

117. $9x - 4(x - 6) = 9x + (-4)[x + (-6)]$

$= 9x + (-4)(x) + (-4)(-6)$

$= 9x + (-4)x + 24$

$= 5x + 24$

119. $-2y + 3(y - 2) = -2y + 3[y + (-2)]$

$= -2y + 3y + 3(-2)$

$= -2y + 3y + (-6)$

$= y - 6$

121. $4n + 2(n + 1) - 5 = 4n + 2(n + 1) + (-5)$

$= 4n + 2n + 2(1) + (-5)$

$= 4n + 2n + 2 + (-5)$

$= 6n - 3$

123. $9y - 3(y - 4) + 8$

$= 9y + (-3)[y + (-4)] + 8$

$= 9y + (-3)(y) + (-3)(-4) + 8$

$= 9y + (-3)y + 12 + 8$

$= 6y + 20$

125. $3x + 2(x + 2) + 5x = 3x + 2x + 2(2) + 5x$

$= 3x + 2x + 4 + 5x$

$= 3x + 2x + 5x + 4$

$= 5x + 5x + 4$

$= 10x + 4$

127. $-7t + 2(t - 3) - t$

$= -7t + 2[t + (-3)] + (-1)t$

$= -7t + 2t + 2(-3) + (-1)t$

$= -7t + 2t + (-6) + (-1)t$

$= -7t + 2t + (-1)t + (-6)$

$= -5t + (-1)t + (-6)$

$= -6t - 6$

129. $z - 2(1 - z) - 2z$
$= z + (-2)\big[1 + (-z)\big] + (-2)z$
$= z + (-2)(1) + (-2)(-z) + (-2)z$
$= z + (-2) + 2z + (-2)z$
$= z + 2z + (-2)z + (-2)$
$= 3z + (-2)z + (-2)$
$= z - 2$

131. $3(y - 2) - 2(y - 6)$
$= 3\big[y + (-2)\big] + (-2)\big[y + (-6)\big]$
$= 3y + 3(-2) + (-2)y + (-2)(-6)$
$= 3y + (-6) + (-2)y + 12$
$= 3y + (-2)y + (-6) + 12$
$= y + 6$

133. $2(t - 3) + 7(t + 3) = 2\big[t + (-3)\big] + 7(t + 3)$
$= 2t + 2(-3) + 7t + 7(3)$
$= 2t + (-6) + 7t + 21$
$= 2t + 7t + (-6) + 21$
$= 9t + 15$

135. $3t - 6(t - 4) + 8t$
$= 3t + (-6)\big[t + (-4)\big] + 8t$
$= 3t + (-6)(t) + (-6)(-4) + 8t$
$= 3t + (-6)t + 24 + 8t$
$= 3t + (-6)t + 8t + 24$
$= -3t + 8t + 24$
$= 5t + 24$

Critical Thinking

137. -5

139. $\frac{3}{2}$

141. $-2x$

143. $\frac{1}{8}$

Projects or Group Activities

145a. $2 + 3x$

1	1	x	x	x

b. $5x$

x	x	x	x	x

c. No. $2 + 3x \neq 5x$. Because 2 and $3x$ are *not* like terms, 2 and $3x$ cannot be combined.

Section 11.2

Concept Check

1a. Expression

b. Equation

c. Equation

d. Equation

e. Expression

f. Expression

Objective A Exercises

3.
$$\begin{array}{r|l} 2x + 9 = 3 & \\ \hline 2(-3) + 9 & 3 \\ -6 + 9 & 3 \\ 3 = 3 & \end{array}$$

Yes, –3 is a solution.

5.
$$\begin{array}{r|l} 4 - 2x = 8 & \\ \hline 4 - 2(2) & 8 \\ 4 - 4 & 8 \\ 0 \neq 8 & \end{array}$$

No, 2 is not a solution.

7. $3x-2=x+4$

$3(3)-2$	$3+4$
$9-2$	7
$7=7$	

Yes, 3 is a solution.

9. $x^2-5x+1=10-5x$

$3^2-5(3)+1$	$10-5(3)$
$9-15+1$	$10-15$
$-5=-5$	

Yes, 3 is a solution.

11. $2x(x-1)=3-x$

$2(-1)(-1-1)$	$3-(-1)$
$-2(-2)$	$3+1$
$4=4$	

Yes, –1 is a solution.

13. $x(x-2)=x^2-4$

$2(2-2)$	2^2-4
$2(0)$	$4-4$
$0=0$	

Yes, 2 is a solution.

15. $3x+6=4$

$3(-\frac{2}{3})+6$	4
$-2+6$	4
$4=4$	

Yes, $-\frac{2}{3}$ is a solution.

17. $2x-3=1-14x$

$2\left(\frac{1}{4}\right)-3$	$1-14\left(\frac{1}{4}\right)$
$\frac{2}{4}-3$	$1-\frac{14}{4}$
$\frac{1}{2}-3$	$1-\frac{7}{2}$
$-2\frac{1}{2}=-2\frac{1}{2}$	

Yes, $\frac{1}{4}$ is a solution.

19. $x^2-3x=x+3.8$

$(-1.9)^2-3(-1.9)$	$-1.9+3.8$
$3.61+5.7$	1.9
$9.31\neq 1.9$	

No, –1.9 is not a solution.

21. True

Objective B Exercises

23. $y-6=16$

$y-6+6=16+6$

$y+0=22$

$y=22$

The solution is 22.

25. $3+n=4$

$3-3+n=4-3$

$0+n=1$

$n=1$

The solution is 1.

27. $z+7=2$

$z+7-7=2-7$

$z+0=-5$

$z=-5$

The solution is -5.

29. $x-3=-7$

$x-3+3=-7+3$

$x+0=-4$

$x=-4$

The solution is -4.

31. $y+6=6$

$y+6-6=6-6$

$y+0=0$

$y=0$

The solution is 0.

33. $-7 = -4 + v$

$-7 + 4 = -4 + 4 + v$

$-3 = 0 + v$

$-3 = v$

The solutions is -3.

35. $1 + x = 0$

$1 - 1 + x = 0 - 1$

$0 + x = 0 + (-1)$

$0 + x = -1$

$x = -1$

The solution is -1.

37. $x - 10 = 5$

$x - 10 + 10 = 5 + 10$

$x + 0 = 15$

$x = 15$

The solution is 15.

39. $4 = -3 + x$

$4 + 3 = -3 + 3 + x$

$7 = 0 + x$

$7 = x$

The solution is 7.

41. $7 = w + 8$

$7 - 8 = w + 8 - 8$

$7 + (-8) = w + 8 - 8$

$-1 = w + 0$

$-1 = w$

The solution is -1.

43. $x + \frac{1}{2} = -\frac{1}{2}$

$x + \frac{1}{2} - \frac{1}{2} = -\frac{1}{2} - \frac{1}{2}$

$x + 0 = -\frac{1}{2} + \left(-\frac{1}{2}\right)$

$x = -1$

The solution is -1.

45. $\frac{2}{5} + x = -\frac{3}{5}$

$\frac{2}{5} - \frac{2}{5} + x = -\frac{3}{5} - \frac{2}{5}$

$0 + x = -\frac{3}{5} + \left(-\frac{2}{5}\right)$

$x = -\frac{5}{5}$

$x = -1$

The solution is -1.

47. $x + \frac{1}{2} = -\frac{1}{3}$

$x + \frac{1}{2} - \frac{1}{2} = -\frac{1}{3} - \frac{1}{2}$

$x + 0 = -\frac{1}{3} + \left(-\frac{1}{2}\right)$

$x = -\frac{5}{6}$

The solution is $-\frac{5}{6}$.

49. $-\frac{1}{2} = t + \frac{1}{4}$

$-\frac{1}{2} - \frac{1}{4} = t + \frac{1}{4} - \frac{1}{4}$

$-\frac{1}{2} + \left(-\frac{1}{4}\right) = t + 0$

$-\frac{3}{4} = t$

The solution is $-\frac{3}{4}$.

51. Must be negative

53. Must be positive

Objective C Exercises

55. $3y = 12$

$\frac{3y}{3} = \frac{12}{3}$

$1y = 4$

$y = 4$

The solution is 4.

57. $5z = -20$

$$\frac{5z}{5} = \frac{-20}{5}$$
$$1z = -4$$
$$z = -4$$

The solution is -4.

59. $-2x = 6$

$$\frac{-2x}{-2} = \frac{6}{-2}$$
$$1x = -3$$
$$x = -3$$

The solution is -3.

61. $-5x = -40$

$$\frac{-5x}{-5} = \frac{-40}{-5}$$
$$1x = 8$$
$$x = 8$$

The solution is 8.

63. $40 = 8x$

$$\frac{40}{8} = \frac{8x}{8}$$
$$5 = 1x$$
$$5 = x$$

The solution is 5.

65. $-24 = 4x$

$$\frac{-24}{4} = \frac{4x}{4}$$
$$-6x = 1x$$
$$-6 = x$$

The solution is -6.

67. $\frac{x}{3} = 5$

$$\frac{1}{3}x = 5$$
$$3\left(\frac{1}{3}x\right) = 3(5)$$
$$1x = 15$$
$$x = 15$$

The solution is 15.

69. $\frac{n}{4} = -2$

$$\frac{1}{4}n = -2$$
$$4\left(\frac{1}{4}n\right) = 4(-2)$$
$$1n = -8$$
$$n = -8$$

The solution is -8.

71. $-\frac{x}{4} = 1$

$$-\frac{1}{4}x = 1$$
$$-4\left(-\frac{1}{4}x\right) = -4(1)$$
$$1x = -4$$
$$x = -4$$

The solution is -4.

73. $\frac{2}{3}w = 4$

$$\frac{3}{2}\left(\frac{2}{3}w\right) = \frac{3}{2}(4)$$
$$1w = 6$$
$$w = 6$$

The solution is 6.

75. $\frac{3}{4}v = -3$

$$\frac{4}{3}\left(\frac{3}{4}v\right) = \frac{4}{3}(-3)$$
$$1v = -4$$
$$v = -4$$

The solution is -4.

77. $-\frac{1}{3}x = -2$

$$-3\left(-\frac{1}{3}x\right) = -3(-2)$$
$$1x = 6$$
$$x = 6$$

The solution is 6.

79. $-4 = -\frac{2}{3}z$

$-\frac{3}{2}(-4) = -\frac{3}{2}\left(-\frac{2}{3}z\right)$

$6 = 1z$

$6 = z$

The solution is 6.

81. $\frac{2}{3}x = -\frac{2}{7}$

$\frac{3}{2}\left(\frac{2}{3}x\right) = \frac{3}{2}\left(-\frac{2}{7}\right)$

$1x = -\frac{3}{7}$

$x = -\frac{3}{7}$

The solution is $-\frac{3}{7}$.

83. $4x - 2x = 7$

$2x = 7$

$\frac{2x}{2} = \frac{7}{2}$

$1x = \frac{7}{2}$

$x = \frac{7}{2}$

The solution is $\frac{7}{2}$.

85. $\frac{4}{5}m - \frac{1}{5}m = 9$

$\frac{3}{5}m = 9$

$\frac{5}{3}\left(\frac{3}{5}m\right) = \frac{5}{3}(9)$

$1m = 15$

$m = 15$

The solution is 15.

87. True

89. False

Objective D Exercises

91. **Strategy** To find the number of gallons of gasoline used, replace the variables D and M in the formula by the given values and solve for G.

Solution

$D = MG$

$621 = 28G$

$\frac{621}{28} = \frac{28G}{28}$

$22.2 \approx G$

22.2 gal of gasoline was used.

93. **Strategy** To find the number of miles per gallon, replace the variables D and G in the formula by the given values and solve for M.

Solution

$D = MG$

$560 = M \cdot 15$

$\frac{560}{15} = \frac{15M}{15}$

$37.3 \approx M$

The car gets 37.3 mi/gal.

95. **Strategy** To find the amount of the original investment, replace the variables A and I by the given values and solve for P.

Solution

$A = P + I$

$17,700 = P + 2700$

$17,700 - 2700 = P + 2700 - 2700$

$17,700 + (-2700) = P + 0$

$15,000 = P$

The original investment was $15,000.

97. **Strategy** To find the increase in value of the investment, replace the variables A and P in the formula by the given values and solve for I.

Solution

$$\begin{aligned} A &= P + I \\ 11,420 &= 8000 + I \\ 11,420 - 8000 &= 8000 - 8000 + I \\ 11,420 + (-8000) &= 0 + I \\ 3420 &= I \end{aligned}$$

The increase is \$3420.

99. **Strategy** To find the cost, replace the variables S and M in the formula by the given values and solve for C.

Solution

$$\begin{aligned} S &= C + M \\ 499 &= C + 175 \\ 499 - 175 &= C + 175 - 175 \\ 499 + (-175) &= C + 0 \\ 324 &= C \end{aligned}$$

The cost of the computer is \$324.

101. **Strategy** To find the cost of a crib, replace the variables S and R in the formula by the given values and solve for C.

Solution

$$\begin{aligned} S &= C + RC \\ 232.50 &= C + 0.24C \\ 232.50 &= 1.24C \\ \frac{232.50}{1.24} &= \frac{1.24C}{1.24} \\ 187.50 &= C \end{aligned}$$

The blender costs \$187.50.

Critical Thinking

103.

$$\begin{aligned} x + a &= b \\ x + 3 &= -5 \\ x + 3 - 3 &= -5 - 3 \\ x + 0 &= -5 + (-3) \\ x &= -8 \end{aligned}$$

The solution is -8.

105.

$$\begin{aligned} (a + b)x &= c \\ [3 + (-5)]x &= 8 \\ -2x &= 8 \\ \frac{-2x}{-2} &= \frac{8}{-2} \\ x &= -4 \end{aligned}$$

The solutions is -4.

107.

$$\begin{aligned} c &= (a - b)x \\ 8 &= [3 - (-5)]x \\ 8 &= (3 + 5)x \\ 8 &= 8x \\ \frac{8}{8} &= \frac{8x}{8} \\ 1 &= x \end{aligned}$$

The solution is 1.

Projects or Group Activities

109.

$$\begin{aligned} x - 3 &= -5 \\ x - 3 + 3 &= -5 + 3 \text{ Addition Property of Equations} \\ x + 0 &= -2 \\ x &= -2 \text{ Addition Property of Zero} \end{aligned}$$

111. Answers will vary. For example, $x + 5 = 1$.

Section 11.3

Concept Check

1. Opposite; 20

Objective A Exercises

3.
$$3x + 5 = 14$$
$$3x + 5 - 5 = 14 - 5$$
$$3x = 9$$
$$\frac{3x}{3} = \frac{9}{3}$$
$$x = 3$$

The solution is 3.

5.
$$2n - 3 = 7$$
$$2n - 3 + 3 = 7 + 3$$
$$2n = 10$$
$$\frac{2n}{2} = \frac{10}{2}$$
$$n = 5$$

The solution is 5.

7.
$$5w + 8 = 3$$
$$5w + 8 - 8 = 3 - 8$$
$$5w = -5$$
$$\frac{5w}{5} = \frac{-5}{5}$$
$$w = -1$$

The solution is -1.

9.
$$3z - 4 = -16$$
$$3z - 4 + 4 = -16 + 4$$
$$3z = -12$$
$$\frac{3z}{3} = \frac{-12}{3}$$
$$z = -4$$

The solution is -4.

11.
$$5 + 2x = 7$$
$$5 - 5 + 2x = 7 - 5$$
$$2x = 2$$
$$\frac{2x}{2} = \frac{2}{2}$$
$$x = 1$$

The solution is 1.

13.
$$6 - x = 3$$
$$6 + (-1)x = 3$$
$$6 - 6 + (-1)x = 3 - 6$$
$$(-1)x = -3$$
$$(-1)(-1)x = (-1)(-3)$$
$$x = 3$$

The solution is 3.

15.
$$3 - 4x = 11$$
$$3 - 3 - 4x = 11 - 3$$
$$-4x = 8$$
$$\frac{-4x}{-4} = \frac{8}{-4}$$
$$x = -2$$

The solution is -2.

17.
$$5 - 4x = 17$$
$$5 - 5 - 4x = 17 - 5$$
$$-4x = 12$$
$$\frac{-4x}{-4} = \frac{12}{-4}$$
$$x = -3$$

The solution is -3.

19.
$$3x + 6 = 0$$
$$3x + 6 - 6 = 0 - 6$$
$$3x = -6$$
$$\frac{3x}{3} = \frac{-6}{3}$$
$$x = -2$$

The solution is -2.

21. $-3x - 4 = -1$

$-3x - 4 + 4 = -1 + 4$

$-3x = 3$

$\frac{-3x}{-3} = \frac{3}{-3}$

$x = -1$

The solution is -1.

23. $12y - 30 = 6$

$12y - 30 + 30 = 6 + 30$

$12y = 36$

$\frac{12y}{12} = \frac{36}{12}$

$y = 3$

The solution is 3.

25. $3c + 7 = 4$

$3c + 7 - 7 = 4 - 7$

$3c = -3$

$\frac{3c}{3} = \frac{-3}{3}$

$c = -1$

The solution is -1.

27. $9x + 13 = 13$

$9x + 13 - 13 = 13 - 13$

$9x = 0$

$\frac{9x}{9} = \frac{0}{9}$

$x = 0$

The solution is 0.

29. $7d - 14 = 0$

$7d - 14 + 14 = 0 + 14$

$7d = 14$

$\frac{7d}{7} = \frac{14}{7}$

$d = 2$

The solution is 2.

31. $3x + 5 = 7$

$3x + 5 - 5 = 7 - 5$

$3x = 2$

$\frac{3x}{3} = \frac{2}{3}$

$x = \frac{2}{3}$

The solution is $\frac{2}{3}$.

33. $6x - 1 = 16$

$6x - 1 + 1 = 16 + 1$

$6x = 17$

$\frac{6x}{6} = \frac{17}{6}$

$x = \frac{17}{6}$

The solution is $\frac{17}{6}$.

35. $-2x - 3 = -7$

$-2x - 3 + 3 = -7 + 3$

$-2x = -4$

$\frac{-2x}{-2} = \frac{-4}{-2}$

$x = 2$

The solution is 2.

37. $3x + 8 = 2$

$3x + 8 - 8 = 2 - 8$

$3x = -6$

$\frac{3x}{3} = \frac{-6}{3}$

$x = -2$

The solution is -2.

39. $3 = 4x - 5$

$3 + 5 = 4x - 5 + 5$

$8 = 4x$

$\frac{8}{4} = \frac{4x}{4}$

$2 = x$

The solution is 2.

41.
$$\begin{aligned} -3 &= 2-5x \\ -3-2 &= 2-2-5x \\ -3+(-2) &= 0-5x \\ -5 &= -5x \\ \frac{-5}{-5} &= \frac{-5x}{-5} \\ 1 &= x \end{aligned}$$

The solution is 1.

43.
$$\begin{aligned} \frac{1}{2}x-2 &= 3 \\ \frac{1}{2}x-2+2 &= 3+2 \\ \frac{1}{2}x &= 5 \\ 2\left(\frac{1}{2}x\right) &= 5\cdot 2 \\ x &= 10 \end{aligned}$$

The solution is 10.

45.
$$\begin{aligned} \frac{3}{5}w-1 &= 2 \\ \frac{3}{5}w-1+1 &= 2+1 \\ \frac{3}{5}w &= 3 \\ \frac{5}{3}\cdot\frac{3}{5}w &= 3\cdot\frac{5}{3} \\ w &= 5 \end{aligned}$$

The solution is 5.

47.
$$\begin{aligned} 3-\frac{2}{9}t &= 5 \\ 3-3-\frac{2}{9}t &= 5-3 \\ -\frac{2}{9}t &= 2 \\ -\frac{9}{2}\left(-\frac{2}{9}\right)t &= -\frac{9}{2}(2) \\ t &= -9 \end{aligned}$$

The solution is -9.

49.
$$\begin{aligned} -3+\frac{5}{8}t &= -13 \\ -3+3+\frac{5}{8}t &= -13+3 \\ \frac{5}{8}t &= -10 \\ \frac{8}{5}\left(\frac{5}{8}\right)t &= \frac{8}{5}(-10) \\ t &= -16 \end{aligned}$$

The solution is -16.

51.
$$\begin{aligned} \frac{x}{3}-2 &= -5 \\ \frac{x}{3}-2+2 &= -5+2 \\ \frac{x}{3} &= -3 \\ 3\cdot\frac{x}{3} &= 3(-3) \\ x &= -9 \end{aligned}$$

The solution is -9.

53.
$$\begin{aligned} \frac{5}{8}v+6 &= 3 \\ \frac{5}{8}v+6-6 &= 3-6 \\ \frac{5}{8}v &= -3 \\ \frac{8}{5}\cdot\frac{5}{8}v &= \frac{8}{5}\cdot(-3) \\ v &= -\frac{24}{5} \end{aligned}$$

The solution is $-\frac{24}{5}$.

55.
$$\begin{aligned} 5 &= \frac{4}{7}z+10 \\ 5-10 &= \frac{4}{7}z+10-10 \\ -5 &= \frac{4}{7}z \\ \frac{7}{4}\cdot(-5) &= \frac{7}{4}\cdot\frac{4}{7}z \\ -\frac{35}{4} &= z \end{aligned}$$

The solution is $-\frac{35}{4}$.

57. $13 = 3 - \frac{5}{9}w$

$13 - 3 = 3 - 3 - \frac{5}{9}w$

$10 = -\frac{5}{9}w$

$-\frac{9}{5}(10) = -\frac{9}{5}\left(-\frac{5}{9}\right)w$

$-18 = w$

The solution is -18.

59. $1.5x - 0.5 = 2.5$

$1.5x - 0.5x + 0.5 = 2.5 + 0.5$

$1.5x = 3$

$\frac{1.5x}{1.5} = \frac{3}{1.5}$

$x = 2$

The solution is 2.

61. $0.8t + 1.1 = 4.3$

$0.8t + 1.1 - 1.1 = 4.3 - 1.1$

$0.8t = 3.2$

$\frac{0.8t}{0.8} = \frac{3.2}{0.8}$

$t = 4$

The solution is 4.

63. $0.4x - 2.3 = 1.3$

$0.4x - 2.3 + 2.3 = 1.3 + 2.3$

$0.4x = 3.6$

$\frac{0.4x}{0.4} = \frac{3.6}{0.4}$

$x = 9$

The solution is 9.

65. $3.5y - 3.5 = 10.5$

$3.5y - 3.5 + 3.5 = 10.5 + 3.5$

$3.5y = 14$

$\frac{3.5y}{3.5} = \frac{14}{3.5}$

$y = 4$

The solution is 4.

67. $6m + 2m - 3 = 5$

$8m - 3 = 5$

$8m - 3 + 3 = 5 + 3$

$8m = 8$

$\frac{8m}{8} = \frac{8}{8}$

$m = 1$

The solution is 1.

69. $-2y + y - 3 = 6$

$-y - 3 = 6$

$-y - 3 + 3 = 6 + 3$

$-y = 9$

$(-1)(-y) = (-1)9$

$y = -9$

The solution is -9.

71. Must be negative

73. Must be positive

Objective B Exercises

75. **Strategy** To find the Celsius temperature, replace the variable F in the formula by the given value and solve for C.

Solution

$F = 1.8C + 32$

$-40 = 1.8C + 32$

$-40 - 32 = 1.8C + 32 - 32$

$-72 = 1.8C$

$\frac{-72}{1.8} = \frac{1.8C}{1.8}$

$-40 = C$

The temperature is –40°C.

77. **Strategy** To find the time required, replace the variables V and V_0 in the formula by the given values and solve for t.

Solution

$$V = V_0 + 32t$$
$$472 = 8 + 32t$$
$$472 - 8 = 8 - 8 + 32t$$
$$464 = 32t$$
$$\frac{464}{32} = \frac{32t}{32}$$
$$14.5 = t$$

The time is 14.5 s.

79. **Strategy** To find the number of units made, replace the variables T, U, and F in the formula by the given values and solve for N.

Solution

$$T = U \cdot N + F$$
$$25{,}000 = 8 \cdot N + 5000$$
$$25{,}000 - 5000 = 8N + 5000 - 5000$$
$$20{,}000 = 8N$$
$$\frac{20{,}000}{8} = \frac{8N}{8}$$
$$2500 = N$$

2500 units were made.

81. **Strategy** To find the total sales, replace the variables M, R, and B in the formula by the given values and solve for S.

Solution

$$M = S \cdot R + B$$
$$3480 = S \cdot 0.09 + 600$$
$$3480 - 600 = 0.09S + 600 - 600$$
$$2880 = 0.09S$$
$$\frac{2880}{0.09} = \frac{0.09S}{0.09}$$
$$32{,}000 = S$$

The total sales were \$32,000.

83. **Strategy** To find the commission rate, replace the variables M, S, and B in the formula by the given values and solve for R.

Solution

$$M = S \cdot R + B$$
$$2640 = 42{,}000R + 750$$
$$2640 - 750 = 42{,}000R + 750 - 750$$
$$1890 = 42{,}000R$$
$$\frac{1890}{42{,}000} = \frac{42{,}000R}{42{,}000}$$
$$0.045 = R$$
$$4.5\% = R$$

Miguel's commission rate was 4.5%.

Critical Thinking

85. No, the sentence "Solve $3x + 4(x - 3)$" does not make sense because $3x + 4(x - 3)$ is an expression, and you cannot solve an expression. You can solve an equation.

Projects or Group Activities

87.

$$\frac{2}{3}x - 4 = 10$$
$$\frac{2}{3}x - 4 + 4 = 10 + 4 \quad \text{Addition Property of Equations}$$
$$\frac{2}{3}x + 0 = 14 \quad \text{Addition Property of Zero}$$
$$\frac{2}{3}x = 14$$
$$\frac{3}{2}\left(\frac{2}{3}x\right) = \frac{3}{2}(14) \quad \text{Multiplication Property of Equations}$$
$$1x = 21 \quad \text{Multiplication Property of Reciprocals}$$
$$x = 21 \quad \text{Multiplication Property of One}$$

Check Your Progress: Chapter 11

1. $3ab - 2c^2 = 3(-5)(2) - 2(-3)^2$
$= 3(-5)(2) - 2(9)$
$= -30 - 18$
$= -30 + (-18)$
$= -48$

2. $4a - 4(b + 2c) = 4(-5) - 4\left[2 + 2(-3)\right]$
$= 4(-5) - 4\left[2 + (-6)\right]$
$= 4(-5) - 4(-4)$
$= -20 - (-16)$
$= -20 + 16$
$= -4$

3. $4 + x = -3$
$4 - 4 + x = -3 - 4$
$x = -7$

The solution is -7.

4. $8 = 2y$
$\frac{8}{2} = \frac{2y}{2}$
$4 = y$

The solution is 4.

5. $-3z + 12 = 0$
$-3z + 12 - 12 = 0 - 12$
$-3z = -12$
$\frac{-3z}{-3} = \frac{-12}{-3}$
$z = 4$

The solution is 4.

6. $5 - 8x = 7$
$5 - 5 - 8x = 7 - 5$
$-8x = 2$
$\frac{-8x}{-8} = \frac{2}{-8}$
$x = -\frac{1}{4}$

The solution is $-\frac{1}{4}$.

7. $-3(-2x) = 6x$

8. $5(2z - 3) = 10z - 15$

9. $7ab - 5b - 9ab + 6b$
$= 7ab + (-5b) + (-9ab) + 6b$
$= 7ab + (-9ab) + (-5b) + 6b$
$= -2ab + b$

10. $-3(4x - 7) + 6(2x + 3) = -12x + 21 + 12x + 18$
$= -12x + 12x + 21 + 18$
$= 39$

11. Commutative Property of Addition

12. Multiplication Property of Reciprocals

13. **Strategy** To find the value, replace the variable P in the formula with the amount invested ($2000) and replace the variable r in the formula with the interest rate (5% = 0.05) and simplify.

Solution $P + rP = 2000 + 0.05(2000)$
$= 2000 + 100$
$= 2100$

The value of the investment is $2100.

Section 11.4

Concept Check

1. Both students were correct.

Objective A Exercises

3. $6x + 3 = 2x + 5$
$6x - 2x + 3 = 2x - 2x + 5$
$4x + 3 = 5$
$4x + 3 - 3 = 5 - 3$
$4x = 2$
$\frac{4x}{4} = \frac{2}{4}$
$x = \frac{1}{2}$

The solution is $\frac{1}{2}$.

5. $3x + 3 = 2x + 2$

$3x - 2x + 3 = 2x - 2x + 2$

$x + 3 = 2$

$x + 3 - 3 = 2 - 3$

$x = -1$

The solution is -1.

7. $5x + 4 = x - 12$

$5x - x + 4 = x - x - 12$

$4x + 4 = -12$

$4x + 4 - 4 = -12 - 4$

$4x = -16$

$\frac{4x}{4} = \frac{-16}{4}$

$x = -4$

The solution is -4.

9. $7b - 2 = 3b - 6$

$7b - 3b - 2 = 3b - 3b - 6$

$4b - 2 = -6$

$4b - 2 + 2 = -6 + 2$

$4b = -4$

$\frac{4b}{4} = \frac{-4}{4}$

$b = -1$

The solution is -1.

11. $9n - 4 = 5n - 20$

$9n - 5n - 4 = 5n - 5n - 20$

$4n - 4 = -20$

$4n - 4 + 4 = -20 + 4$

$4n = -16$

$\frac{4n}{4} = \frac{-16}{4}$

$n = -4$

The solution is -4.

13. $2x + 1 = 16 - 3x$

$2x + 3x + 1 = 16 - 3x + 3x$

$5x + 1 = 16$

$5x + 1 - 1 = 16 - 1$

$5x = 15$

$\frac{5x}{5} = \frac{15}{5}$

$x = 3$

The solution is 3.

15. $5x - 2 = -10 - 3x$

$5x + 3x - 2 = -10 - 3x + 3x$

$8x - 2 = -10$

$8x - 2 + 2 = -10 + 2$

$8x = -8$

$\frac{8x}{8} = \frac{-8}{8}$

$x = -1$

The solution is -1.

17. $2x + 7 = 4x + 3$

$2x - 4x + 7 = 4x - 4x + 3$

$-2x + 7 = 3$

$-2x + 7 - 7 = 3 - 7$

$-2x = -4$

$\frac{-2x}{-2} = \frac{-4}{-2}$

$x = 2$

The solution is 2.

19. $c + 4 = 6c - 11$

$c - 6c + 4 = 6c - 6c - 11$

$-5c + 4 = -11$

$-5c + 4 - 4 = -11 - 4$

$-5c = -15$

$\frac{-5c}{-5} = \frac{-15}{-5}$

$c = 3$

The solution is 3.

21. $3x - 7 = x - 7$
$3x - x - 7 = x - x - 7$
$2x - 7 = -7$
$2x - 7 + 7 = -7 + 7$
$2x = 0$
$\frac{2x}{2} = \frac{0}{2}$
$x = 0$

The solution is 0.

23. $3 - 4x = 5 - 3x$
$3 - 4x + 3x = 5 - 3x + 3x$
$3 - x = 5$
$3 - 3 - x = 5 - 3$
$-x = 2$
$(-1)(-x) = (-1)2$
$x = -2$

The solution is -2.

25. $7 + 3x = 9 + 5x$
$7 + 3x - 5x = 9 + 5x - 5x$
$7 - 2x = 9$
$7 - 7 - 2x = 9 - 7$
$-2x = 2$
$\frac{-2x}{-2} = \frac{2}{-2}$
$x = -1$

The solution is -1.

27. $5 + 2y = 7 + 5y$
$5 + 2y - 5y = 7 + 5y - 5y$
$5 - 3y = 7$
$5 - 5 - 3y = 7 - 5$
$-3y = 2$
$\frac{-3y}{-3} = \frac{2}{-3}$
$y = -\frac{2}{3}$

The solution is $-\frac{2}{3}$.

29. $8 - 5w = 4 - 6w$
$8 - 5w + 6w = 4 - 6w + 6w$
$8 + w = 4$
$8 - 8 + w = 4 - 8$
$w = -4$

The solution is -4.

31. $6x + 1 = 3x + 2$
$6x - 3x + 1 = 3x - 3x + 2$
$3x + 1 = 2$
$3x + 1 - 1 = 2 - 1$
$3x = 1$
$\frac{3x}{3} = \frac{1}{3}$
$x = \frac{1}{3}$

The solution is $\frac{1}{3}$.

33. $5x + 8 = x + 5$
$5x - x + 8 = x - x + 5$
$4x + 8 = 5$
$4x + 8 - 8 = 5 - 8$
$4x = -3$
$\frac{4x}{4} = \frac{-3}{4}$
$x = -\frac{3}{4}$

The solution is $-\frac{3}{4}$.

35. $2x - 3 = 6x - 4$
$2x - 6x - 3 = 6x - 6x - 4$
$-4x - 3 = -4$
$-4x - 3 + 3 = -4 + 3$
$-4x = -1$
$\frac{-4x}{-4} = \frac{-1}{-4}$
$x = \frac{1}{4}$

The solution is $\frac{1}{4}$.

37. $6 - 3x = 6 - 5x$

$6 - 3x + 5x = 6 - 5x + 5x$

$6 + 2x = 6$

$6 - 6 + 2x = 6 - 6$

$2x = 0$

$\frac{2x}{2} = \frac{0}{2}$

$x = 0$

The solution is 0.

39. $6x - 2 = 2x - 9$

$6x - 2x - 2 = 2x - 2x - 9$

$4x - 2 = -9$

$4x - 2 + 2 = -9 + 2$

$4x = -7$

$\frac{4x}{4} = \frac{-7}{4}$

$x = -\frac{7}{4}$

The solution is $\frac{7}{4}$.

41. $6x - 3 = -5x + 8$

$6x + 5x - 3 = -5x + 5x + 8$

$11x - 3 = 8$

$11x - 3 + 3 = 8 + 3$

$11x = 11$

$\frac{11x}{11} = \frac{11}{11}$

$x = 1$

The solution is 1.

43. $-6t - 2 = -8t - 4$

$-6t + 8t - 2 = -8t + 8t - 4$

$2t - 2 = -4$

$2t - 2 + 2 = -4 + 2$

$2t = -2$

$\frac{2t}{2} = \frac{-2}{2}$

$t = -1$

The solution is -1.

45. $-3 - 4x = 7 - 2x$

$-3 - 4x + 2x = 7 - 2x + 2x$

$-3 - 2x = 7$

$-3 + 3 - 2x = 7 + 3$

$-2x = 10$

$\frac{-2x}{-2} = \frac{10}{-2}$

$x = -5$

The solution is -5.

47. $3 - 7x = -2 + 5x$

$3 - 7x - 5x = -2 + 5x - 5x$

$3 - 12x = -2$

$3 - 3 - 12x = -2 - 3$

$-12x = -5$

$\frac{-12x}{-12} = \frac{-5}{-12}$

$x = \frac{5}{12}$

The solution is $\frac{5}{12}$.

49. $5x + 8 = 4 - 2x$

$5x + 2x + 8 = 4 - 2x + 2x$

$7x + 8 = 4$

$7x + 8 - 8 = 4 - 8$

$7x = -4$

$\frac{7x}{7} = \frac{-4}{7}$

$x = -\frac{4}{7}$

The solution is $-\frac{4}{7}$.

51. $12z - 9 = 3z + 12$

$12z - 3z - 9 = 3z - 3z + 12$

$9z - 9 = 12$

$9z - 9 + 9 = 12 + 9$

$9z = 21$

$\frac{9z}{9} = \frac{21}{9}$

$z = \frac{7}{3}$

The solution is $\frac{7}{3}$.

53. $\frac{5}{7}m - 3 = \frac{2}{7}m + 6$

$\frac{5}{7}m - \frac{2}{7}m - 3 = \frac{2}{7}m - \frac{2}{7}m + 6$

$\frac{3}{7}m - 3 = 6$

$\frac{3}{7}m - 3 + 3 = 6 + 3$

$\frac{3}{7}m = 9$

$\frac{7}{3} \cdot \frac{3}{7}m = \frac{7}{3} \cdot 9$

$m = 21$

The solution is 21.

55. $\frac{3}{7}x + 5 = \frac{5}{7}x - 7$

$\frac{3}{7}x - \frac{5}{7}x + 5 = \frac{5}{7}x - \frac{5}{7}x - 1$

$\frac{-2}{7}x + 5 = -1$

$\frac{-2}{7}x + 5 - 5 = -1 - 5$

$\frac{-2}{7}x = -6$

$\left(\frac{-7}{2}\right)\left(\frac{-2}{7}x\right) = \left(\frac{-7}{2}\right)(-6)$

$x = 21$

The solution is 21.

57. Positive

Objective B Exercises

59. (iv)

61. $6x + 2(x - 1) = 14$

$6x + 2x - 2 = 14$

$8x - 2 = 14$

$8x - 2 + 2 = 14 + 2$

$8x = 16$

$\frac{8x}{8} = \frac{16}{8}$

$x = 2$

The solution is 2.

63. $-3 + 4(x + 3) = 5$

$-3 + 4x + 12 = 5$

$4x + 9 = 5$

$4x + 9 - 9 = 5 - 9$

$4x = -4$

$\frac{4x}{4} = \frac{-4}{4}$

$x = -1$

The solution is -1.

65. $6 - 2(d + 4) = 6$

$6 - 2d - 8 = 6$

$-2d - 2 = 6$

$-2d - 2 + 2 = 6 + 2$

$-2d = 8$

$\frac{-2d}{-2} = \frac{8}{-2}$

$d = -4$

The solution is -4.

67. $5 + 7(x + 3) = 20$

$5 + 7x + 21 = 20$

$7x + 26 = 20$

$7x + 26 - 26 = 20 - 26$

$7x = -6$

$\frac{7x}{7} = \frac{-6}{7}$

$x = -\frac{6}{7}$

The solution is $-\frac{6}{7}$.

69. $2x + 3(x - 5) = 10$

$$2x + 3x - 15 = 10$$
$$5x - 15 = 10$$
$$5x - 15 + 15 = 10 + 15$$
$$5x = 25$$
$$\frac{5x}{5} = \frac{25}{5}$$
$$x = 5$$

The solution is 5.

71. $3(x - 4) + 2x = 3$

$$3x - 12 + 2x = 3$$
$$5x - 12 = 3$$
$$5x - 12 + 12 = 3 + 12$$
$$5x = 15$$
$$\frac{5x}{5} = \frac{15}{5}$$
$$x = 3$$

The solution is 3.

73. $2x - 3(x - 4) = 12$

$$2x - 3x + 12 = 12$$
$$-x + 12 = 12$$
$$-x + 12 - 12 = 12 - 12$$
$$-x = 0$$
$$(-1)(-x) = (-1)0$$
$$x = 0$$

The solution is 0.

75. $2x + 3(x + 4) = 7$

$$2x + 3x + 12 = 7$$
$$5x + 12 = 7$$
$$5x + 12 - 12 = 7 - 12$$
$$5x = -5$$
$$\frac{5x}{5} = \frac{-5}{5}$$
$$x = -1$$

The solution is -1.

77. $3(x - 2) + 5 = 5$

$$3x - 6 + 5 = 5$$
$$3x - 1 = 5$$
$$3x - 1 + 1 = 5 + 1$$
$$3x = 6$$
$$\frac{3x}{3} = \frac{6}{3}$$
$$x = 2$$

The solution is 2.

79. $3y + 7(y - 2) = 5$

$$3y + 7y - 14 = 5$$
$$10y - 14 = 5$$
$$10y - 14 + 14 = 5 + 14$$
$$10y = 19$$
$$\frac{10y}{10} = \frac{19}{10}$$
$$y = \frac{19}{10}$$

The solution is $\frac{19}{10}$.

81. $4b - 2(b + 9) = 8$

$$4b - 2b - 18 = 8$$
$$2b - 18 = 8$$
$$2b - 18 + 18 = 8 + 18$$
$$2b = 26$$
$$\frac{2b}{2} = \frac{26}{2}$$
$$b = 13$$

The solution is 13.

83. $3x + 5(x - 2) = 10$

$$3x + 5x - 10 = 10$$
$$8x - 10 = 10$$
$$8x - 10 + 10 = 10 + 10$$
$$8x = 20$$
$$\frac{8x}{8} = \frac{20}{8}$$
$$x = \frac{5}{2}$$

The solution is $\frac{5}{2}$.

85. $3x + 4(x + 2) = 2(x + 9)$

$$3x + 4x + 8 = 2x + 18$$

$$7x + 8 = 2x + 18$$

$$7x - 2x + 8 = 2x - 2x + 18$$

$$5x + 8 = 18$$

$$5x + 8 - 8 = 18 - 8$$

$$5x = 10$$

$$\frac{5x}{10} = \frac{10}{5}$$

$$x = 2$$

The solution is 2.

87. $2d - 3(d - 4) = 2(d + 6)$

$$2d - 3d + 12 = 2d + 12$$

$$-d + 12 = 2d + 12$$

$$-d - 2d + 12 = 2d - 2d + 12$$

$$-3d + 12 = 12$$

$$-3d + 12 - 12 = 12 - 12$$

$$-3d = 0$$

$$\frac{-3d}{-3} = \frac{0}{-3}$$

$$d = 0$$

The solution is 0.

89. $7 - 2(x - 3) = 3(x - 1)$

$$7 - 2x + 6 = 3x - 3$$

$$-2x + 13 = 3x - 3$$

$$-2x - 3x + 13 = 3x - 3x - 3$$

$$-5x + 13 = -3$$

$$-5x + 13 - 13 = -3 - 13$$

$$-5x = -16$$

$$\frac{-5x}{-5} = \frac{-16}{-5}$$

$$x = \frac{16}{5}$$

The solution is $\frac{16}{5}$.

91. $6x - 2(x - 3) = 11(x - 2)$

$$6x - 2x + 6 = 11x - 22$$

$$4x + 6 = 11x - 22$$

$$4x - 11x + 6 = 11x - 11x - 22$$

$$-7x + 6 = -22$$

$$-7x + 6 - 6 = -22 - 6$$

$$-7x = -28$$

$$\frac{-7x}{-7} = \frac{-28}{-7}$$

$$x = 4$$

The solution is 4.

93. $6c - 3(c + 1) = 5(c + 2)$

$$6c - 3c - 3 = 5c + 10$$

$$3c - 3 = 5c + 10$$

$$3c - 5c - 3 = 5c - 5c + 10$$

$$-2c - 3 = 10$$

$$-2c - 3 + 3 = 10 + 3$$

$$-2c = 13$$

$$\frac{-2c}{-2} = \frac{13}{-2}$$

$$c = -\frac{13}{2}$$

The solution is $-\frac{13}{2}$.

95. $7 - (x + 1) = 3(x + 3)$

$$7 - x - 1 = 3x + 9$$

$$-x + 6 = 3x + 9$$

$$-x - 3x + 6 = 3x - 3x + 9$$

$$-4x + 6 = 9$$

$$-4x + 6 - 6 = 9 - 6$$

$$-4x = 3$$

$$\frac{-4x}{-4} = \frac{3}{-4}$$

$$x = -\frac{3}{4}$$

The solution is $-\frac{3}{4}$.

97. $2x - 3(x + 4) = 2(x - 5)$

$$2x - 3x - 12 = 2x - 10$$

$$-x - 12 = 2x - 10$$

$$-x - 2x - 12 = 2x - 2x - 10$$

$$-3x - 12 = -10$$

$$-3x - 12 + 12 = -10 + 12$$

$$-3x = 2$$

$$\frac{-3x}{-3} = \frac{2}{-3}$$

$$x = -\frac{2}{3}$$

The solution is $-\frac{2}{3}$.

99. $x + 5(x - 4) = 3(x - 8) - 5$

$$x + 5x - 20 = 3x - 24 - 5$$

$$6x - 20 = 3x - 29$$

$$6x - 3x - 20 = 3x - 3x - 29$$

$$3x - 20 = -29$$

$$3x - 20 + 20 = -29 + 20$$

$$3x = -9$$

$$\frac{3x}{3} = \frac{-9}{3}$$

$$x = -3$$

The solution is -3.

101. $9b - 3(b - 4) = 13 + 2(b - 3)$

$$9b - 3b + 12 = 13 + 2b - 6$$

$$6b + 12 = 2b + 7$$

$$6b - 2b + 12 = 2b - 2b + 7$$

$$4b + 12 = 7$$

$$4b + 12 - 12 = 7 - 12$$

$$4b = -5$$

$$\frac{4b}{4} = \frac{-5}{4}$$

$$b = -\frac{5}{4}$$

The solution is $-\frac{5}{4}$.

103. $3(x - 4) + 3x = 7 - 2(x - 1)$

$$3x - 12 + 3x = 7 - 2x + 2$$

$$6x - 12 = -2x + 9$$

$$6x + 2x - 12 = -2x + 2x + 9$$

$$8x - 12 = 9$$

$$8x - 12 + 12 = 9 + 12$$

$$8x = 21$$

$$\frac{8x}{8} = \frac{21}{8}$$

$$x = \frac{21}{8}$$

The solution is $\frac{21}{8}$.

105.
$$3.67x - 5.3(x - 1.932) = 6.99$$
$$3.67x - 5.3x + 10.2396 = 6.99$$
$$-1.63x + 10.2396 = 6.99$$
$$-1.63x + 10.2396 - 10.2396 = 6.99 - 10.2396$$
$$-1.63x = -3.2496$$
$$\frac{-1.63x}{-1.63} = \frac{-3.2496}{-1.63}$$
$$x \approx 1.9936196$$

The solution is 1.99.

Critical Thinking

107.
$$2x - 2 = 4x + 6$$
$$2x - 4x - 2 = 4x - 4x + 6$$
$$-2x - 2 = 6$$
$$-2x - 2 + 2 = 6 + 2$$
$$-2x = 8$$
$$x = -4$$

Then $3x^2 = 3(-4)^2 = 48$.

Projects or Group Activities

109. Many beginning algebra students do not differentiate between an equation that has no solution and an equation whose solution is zero. Students should explain that zero is a (real) number and that the solution of the equation $2x + 3 = 3$ is the (real) number zero. However, there is no solution to the equation $x = x + 1$ because there is no (real) number that is equal to itself plus 1.

Section 11.5

Concept Check

1. No

Objective A Exercises

3. $y - 9$

5. $z + 3$

7. $\frac{2}{3}n + n$

9. $\frac{m}{m-3}$

11. $9(x + 4)$

13. $x - \frac{x}{2}$

15. $\frac{z-3}{z}$

17. $2(t + 6)$

19. $\frac{x}{9+x}$

21. $3(b + 6)$

23a. 3 more than twice x

b. Twice the sum of x and 3

Objective B Exercises

25. The *square* of a number

The unknown number: x

x^2

27. A number *divided* by twenty

The unknown number: x

$\frac{x}{20}$

29. Four *times* some number

The unknown number: x

$4x$

31. Three-fourths *of* a number

The unknown number: x

$\frac{3}{4}x$

33. Four *increased* by some number

The unknown number: x

$4 + x$

35. The *difference between* five *times* a number and the number

The unknown number: x

Five times the number: $5x$

$5x - x$

37. The *product* of a number and two *more than* the number

The unknown number: x

Two more than the number: $x + 2$

$x(x + 2)$

39. Seven *times* the *total* of a number and eight

The unknown number: x

The total of the number and eight: $x + 8$

$7(x + 8)$

41. The *square* of a number *plus* the *product* of three and the number

The unknown number: x

The square of the number: x^2

The product of three and the number: $3x$

$x^2 + 3x$

43. The *sum* of three *more than* a number and *one-half* of the number

The unknown number: x

Three more than the number: $x + 3$

One-half of the number: $\frac{1}{2}x$

$(x + 3) + \frac{1}{2}x$

45. No

Critical Thinking

47. $\frac{a+3}{4}$

49. $\frac{4c}{7}-9$

Projects or Group Activities

51. $2x$

Section 11.6

Concept Check

1. No

Objective A Exercises

3. The unknown number: x

$$\begin{aligned} x+7&=12\\ x+7-7&=12-7\\ x&=5 \end{aligned}$$

The number is 5.

5. The unknown number: x

$$\begin{aligned} 3x&=18\\ \frac{3x}{3}&=\frac{18}{3}\\ x&=6 \end{aligned}$$

The number is 6.

7. The unknown number: x

$$\begin{aligned} x+5&=3\\ x+5-5&=3-5\\ x&=-2 \end{aligned}$$

The number is –2.

9. The unknown number: x

$$\begin{aligned} 6x&=14\\ \frac{6x}{6}&=\frac{14}{6}\\ x&=\frac{7}{3} \end{aligned}$$

The number is $\frac{7}{3}$.

11. The unknown number: x

$$\begin{aligned} \frac{5}{6}x&=15\\ \frac{6}{5}\cdot\frac{5}{6}x&=\frac{6}{5}\cdot 15\\ x&=18 \end{aligned}$$

The number is 18.

13. The unknown number: x

$$\begin{aligned} 3x+4&=8\\ 3x+4-4&=8-4\\ 3x&=4\\ \frac{3x}{3}&=\frac{4}{3}\\ x&=\frac{4}{3} \end{aligned}$$

The number is $\frac{4}{3}$.

15. The unknown number: x

$$\begin{aligned} \frac{1}{4}x-7&=9\\ \frac{1}{4}x-7+7&=9+7\\ \frac{1}{4}x&=16\\ 4\cdot\frac{1}{4}x&=4\cdot 16\\ x&=64 \end{aligned}$$

The number is 64.

17. The unknown number: x

$$\frac{x}{9} = 14$$
$$9 \cdot \frac{x}{9} = 9 \cdot 14$$
$$x = 126$$

The number is 126.

19. The unknown number: x

$$\frac{x}{4} - 6 = -2$$
$$\frac{x}{4} - 6 + 6 = -2 + 6$$
$$\frac{x}{4} = 4$$
$$4 \cdot \frac{x}{4} = 4 \cdot 4$$
$$x = 16$$

The number is 16.

21. The unknown number: x

$$7 - 2x = 13$$
$$7 - 7 - 2x = 13 - 7$$
$$-2x = 6$$
$$\frac{-2x}{-2} = \frac{6}{-2}$$
$$x = -3$$

The number is –3.

23. The unknown number: x

$$9 - \frac{x}{2} = 5$$
$$9 - 9 - \frac{x}{2} = 5 - 9$$
$$-\frac{x}{2} = -4$$
$$(-2)\left(-\frac{x}{2}\right) = (-2)(-4)$$
$$x = 8$$

The number is 8.

25. The unknown number: x

$$\frac{3}{5}x + 8 = 2$$
$$\frac{3}{5}x + 8 - 8 = 2 - 8$$
$$\frac{3}{5}x = -6$$
$$\frac{5}{3} \cdot \frac{3}{5}x = \frac{5}{3} \cdot (-6)$$
$$x = -10$$

The number is –10.

27. The unknown number: x

$$\frac{x}{4.18} - 7.92 = 12.52$$
$$\frac{x}{4.18} - 7.92 + 7.92 = 12.52 + 7.92$$
$$\frac{x}{4.18} = 20.44$$
$$4.18 \cdot \frac{x}{4.18} = 4.18(20.44)$$
$$x = 85.4392$$

The number is 85.4392.

29. No

Objective B Exercises

31. The median price of a house in 2005

33. **Strategy** To find the length of the Brooklyn Bridge, write and solve an equation using L to represent the length of the Brooklyn Bridge.

Solution

1991 m	is	1505 m greater than the length of the Brooklyn Bridge.

$$1991 = L + 1505$$
$$1991 - 1505 = L + 1505 - 1505$$
$$486 = L$$

The length of the Brooklyn Bridge is 486 m.

35. **Strategy** To find the amount the Army plans to pay, write and solve and equation using C to represent the amount paid in 2009.

Solution

\$626 million	is	\$182 million more than the amount the Army plans to pay in 2010.

$$626 = 182 + C$$
$$626 - 182 = 182 - 182 + C$$
$$444 = C$$

The Army plans to pay out \$444 million in re-enlistment bonuses in 2010.

37. **Strategy** To find the value of the SUV last year, write and solve an equation using V to represent the value of the SUV last year

Solution

\$16,000	is	four-fifths of its value last year.

$$16{,}000 = \frac{4}{5}V$$
$$\frac{5}{4} \cdot 16{,}000 = \frac{5}{4} \cdot \frac{4}{5}V$$
$$20{,}000 = V$$

The value of the SUV last year was \$20,000.

39. **Strategy** To find the number of hours, write and solve an equation using h to represent the number of hours infants sleep each day.

Solution

9.5 h	is	three-fourths the number of hours infants sleep.

$$9.5 = \frac{3}{4}h$$
$$\frac{4}{3} \cdot 9.5 = \frac{4}{3} \cdot \frac{3}{4}h$$
$$12.7 \approx h$$

Infants aged 3 months to 11 months sleep an average of 12.7 h each day.

41. **Strategy** To find the cost of the calculator 5 years ago, write and solve an equation using C to represent the cost 5 years ago.

Solution

\$72	is	three-fourths of the cost 5 years ago.

$$72 = \frac{3}{4}C$$
$$\frac{4}{3} \cdot 72 = \frac{4}{3} \cdot \frac{3}{4}C$$
$$96 = C$$

The cost of the calculator 5 years ago was \$96.

43. **Strategy** To find the recommended daily allowance of sodium:

- Write and solve an equation using x to represent the daily allowance of sodium.
- Convert the milligrams to grams.

Solution

8% of the daily recommended allowance	is	200 mg.

$$8\% \cdot x = 200$$
$$0.08x = 200$$
$$\frac{0.08x}{0.08} = \frac{200}{0.08}$$
$$x = 2{,}500$$

2,500 mg = 2.5g

The recommended daily allowance of sodium is 2.5 g.

45. **Strategy** To find the number of species of animals known to be at risk, write and solve an equation using P to represent the number of species of animals.

Solution

12.24% of all species known to be at risk	is	1130 species of mammals.

$$12.24\% \cdot P = 1130$$
$$0.1224P = 1130$$
$$\frac{0.1224P}{0.1224} = \frac{1130}{0.1224}$$
$$P \approx 9230$$

About 9230 species of animals were known to be at risk of extinction in the world.

47. **Strategy** To find the number of hot dogs, write and solve an equation using x to represent the number of hot dogs Americans consume annually.

Solution

7 billion	is	35% of the number consumed annually.

$$7 = 35\% \cdot x$$
$$7 = 0.35x$$
$$\frac{7}{0.35} = \frac{0.35}{0.35}x$$
$$20 = x$$

Americans consume 20 billion hot dogs annually.

49. Strategy To find the number of hours of labor required to install a water softener, write and solve an equation using T to represent the time it took to install the water softener.

Solution

The total charge of \$445	is	\$310 for the water softener plus \$45 per hour for labor.

$$445 = 310 + 45T$$
$$445 - 310 = 310 - 310 + 45T$$
$$135 = 45T$$
$$\frac{135}{45} = \frac{45T}{45}$$
$$3 = T$$

It took 3 h to install the water softener.

51. Strategy To find the number of vacation days, write and solve an equation using d to represent the number of vacation days U.S. workers take per year.

Solution

42 days	is	3 more than three times the number of vacation days taken by U.S. workers.

$$42 = 3d + 3$$
$$42 - 3 = 3d + 3 - 3$$
$$39 = 3d$$
$$\frac{39}{3} = \frac{3d}{3}$$
$$13 = d$$

U.S. workers take an average of 13 days of vacation each year.

53. Strategy To find the total sales for the month, write and solve an equation using T to represent the total sales.

Solution

The base monthly salary of \$600 plus an 8.25% commission on total sales	is	\$4109.55.

$$\begin{aligned} 600 + 0.0825T &= 4109.55 \\ 600 - 600 + 0.0825T &= 4109.55 - 600 \\ 0.0825T &= 3509.55 \\ \frac{0.0825T}{0.0825} &= \frac{3509.55}{0.0825} \\ T &= 42{,}540 \end{aligned}$$

The total sales for the month were \$42,540.

Critical Thinking

55. $\frac{1}{f} = \frac{1}{o} + \frac{1}{i}$

57. $s = 16t^2$

Chapter 11 Review Exercises

1. $\begin{aligned} -2(a-b) &= -2\left[a + (-b)\right] \\ &= -2(a) + (-2)(-b) \\ &= -2a + 2b \end{aligned}$

2.
$$\begin{array}{r|l} 3x - 2 = -8 & \\ \hline 3(-2) - 2 & -8 \\ -6 - 2 & -8 \\ -6 + (-2) & -8 \\ -8 = -8 & \end{array}$$

Yes, –2 is a solution.

3. $\begin{aligned} x - 3 &= -7 \\ x - 3 + 3 &= -7 + 3 \\ x &= -4 \end{aligned}$

The solution is -4.

4. $\begin{aligned} -2x + 5 &= -9 \\ -2x + 5 - 5 &= -9 - 5 \\ -2x &= -14 \\ \frac{-2x}{-2} &= \frac{-14}{-2} \\ x &= 7 \end{aligned}$

The solution is 7.

5. $\begin{aligned} a^2 - 3b &= 2^2 - 3(-3) \\ &= 4 + 9 = 13 \end{aligned}$

6. $\begin{aligned} -3x &= 27 \\ \frac{-3x}{-3} &= \frac{27}{-3} \\ x &= -9 \end{aligned}$

The solution is -9.

7. $\begin{aligned} \frac{2}{3}x + 3 &= -9 \\ \frac{2}{3}x + 3 - 3 &= -9 - 3 \\ \frac{2}{3}x &= -12 \\ \frac{3}{2} \cdot \frac{2}{3}x &= \frac{3}{2}(-12) \\ x &= -18 \end{aligned}$

The solution is -18.

8. $\begin{aligned} 3x - 2(3x - 2) &= 3x + (-2)\left[3x + (-2)\right] \\ &= 3x + (-2)(3x) + (-2)(-2) \\ &= 3x + (-6x) + 4 \\ &= -3x + 4 \end{aligned}$

9. $6x - 9 = -3x + 36$

$6x + 3x - 9 = -3x + 3x + 36$

$9x - 9 = 36$

$9x - 9 + 9 = 36 + 9$

$9x = 45$

$\frac{9x}{9} = \frac{45}{9}$

$x = 5$

The solution is 5.

10. $x + 3 = -2$

$x + 3 - 3 = -2 - 3$

$x = -5$

The solution is -5.

11. $3x - 5 = -10$

$3(5) - 5$	-10
$15 - 5$	-10
$15 + (-5)$	-10
$10 \neq -10$	

No, 5 is not a solution.

12. $a^2 - (b \div c) = (-2)^2 - [8 \div (-4)]$

$= 4 - (-2) = 6$

13. $3(x - 2) + 2 = 11$

$3x - 6 + 2 = 11$

$3x - 4 = 11$

$3x - 4 + 4 = 11 + 4$

$3x = 15$

$\frac{3x}{3} = \frac{15}{3}$

$x = 5$

The solution is 5.

14. $35 - 3x = 5$

$35 - 35 - 3x = 5 - 35$

$-3x = -30$

$\frac{-3x}{-3} = \frac{-30}{-3}$

$x = 10$

The solution is 10.

15. $6bc - 7bc + 2bc - 5bc$

$= 6bc + (-7)bc + 2bc + (-5)bc$

$= (-1)bc + 2bc + (-5)bc$

$= 1bc + (-5)bc$

$= -4bc$

16. $7 - 3x = 2 - 5x$

$7 - 3x + 5x = 2 - 5x + 5x$

$7 + 2x = 2$

$7 - 7 + 2x = 2 - 7$

$2x = -5$

$\frac{2x}{2} = \frac{-5}{2}$

$x = \frac{-5}{2} = -\frac{5}{2}$

The solution is $-\frac{5}{2}$.

17. $-\frac{3}{8}x = -\frac{15}{32}$

$-\frac{8}{3}\left(-\frac{3}{8}x\right) = \left(-\frac{8}{3}\right)\left(-\frac{15}{32}\right)$

$x = \frac{5}{4}$

The solution is $\frac{5}{4}$.

18. $\frac{1}{2}x^2 - \frac{1}{3}x^2 + \frac{1}{5}x^2 + 2x^2$

$= \frac{1}{2}x^2 + \left(-\frac{1}{3}\right)x^2 + \frac{1}{5}x2 + 2x^2$

$= \frac{3}{6}x^2 + \left(-\frac{2}{6}\right)x^2 + \frac{1}{5}x^2 + 2x^2$

$= \frac{1}{6}x^2 + \frac{1}{5}x^2 + 2x^2$

$= \frac{5}{30}x^2 + \frac{6}{30}x^2 + 2x^2$

$= \frac{11}{30}x^2 + 2x^2$

$= \frac{11}{30}x^2 + \frac{60}{30}x^2$

$= \frac{71}{30}x^2$

19. $5x - 3(1 - 2x) = 4(2x - 1)$

$$5x - 3 + 6x = 8x - 4$$

$$11x - 3 = 8x - 4$$

$$11x - 8x - 3 = 8x - 8x - 4$$

$$3x - 3 = -4$$

$$3x - 3 + 3 = -4 + 3$$

$$3x = -1$$

$$\frac{3x}{3} = \frac{-1}{3}$$

$$x = -\frac{1}{3}$$

The solution is $-\frac{1}{3}$.

20. $\frac{5}{6}x - 4 = 5$

$$\frac{5}{6}x - 4 + 4 = 5 + 4$$

$$\frac{5}{6}x = 9$$

$$\frac{6}{5} \cdot \frac{5}{6}x = \frac{6}{5} \cdot 9$$

$$x = \frac{54}{5}$$

The solution is $\frac{54}{5}$.

21. **Strategy** To find the number of miles per gallon of gas, replace D and G in the formula by the given values and solve for M.

Solution

$$D = M \cdot G$$

$$621 = M \cdot 27$$

$$\frac{621}{27} = \frac{27M}{27}$$

$$23 = M$$

The mileage obtained was 23 mi/gal.

22. **Strategy** To find the Celsius temperature, replace the variable F in the formula by the given value and solve for C.

Solution

$$F = 1.8C + 32$$

$$100 = 1.8C + 32$$

$$100 - 32 = 1.8C + 32 - 32$$

$$68 = 1.8C$$

$$37.8 \approx C$$

The temperature is 37.8°C.

23. The *total* of n and the *quotient* of n and 5

The unknown number: n

The quotient of n and 5: $\frac{n}{5}$

$$n + \frac{n}{5}$$

24. The *sum* of five more than a number and one-third *of* the number

The unknown number: n

Five more than the number: $n + 5$

One-third of the number: $\frac{1}{3}n$

$$(n + 5) + \frac{1}{3}n$$

25. The unknown number: x

$$9 - 2x = 5$$

$$9 - 9 - 2x = 5 - 9$$

$$-2x = -4$$

$$\frac{-2x}{-2} = \frac{-4}{-2}$$

$$x = 2$$

The number is 2.

26. The unknown number: p

$$5p = 50$$

$$\frac{5p}{5} = \frac{50}{5}$$

$$p = 10$$

The number is 10.

27. **Strategy** To find the regular price, write and solve an equation using R to represent the regular price.

Solution

\$392	is	80% of the regular price.

$$392 = 80\% \cdot R$$
$$392 = 0.80R$$
$$\frac{392}{0.80} = \frac{0.80R}{0.80}$$
$$490 = R$$

The regular price of the tablet PC is \$490.

28. **Strategy** Let x represent last year's crop. Then $0.12x$ is the increase in last year's crop. Last year's crop plus the increase is this year's crop (28,336 bushels).

Solution

A 12% increase over last year's crop	is	28,336 bushels.

$$0.12x + x = 26{,}336$$
$$1.12x = 28{,}336$$
$$x = 25{,}300$$

Last year's crop was 25,300 bushels.

Chapter 11 Test

1. $\frac{x}{5} - 12 = 7$

$$\frac{x}{5} - 12 + 12 = 7 + 12$$
$$\frac{x}{5} = 19$$
$$5 \cdot \frac{x}{5} = 5 \cdot 19$$
$$x = 95$$

The solution is 95.

2. $x - 12 = 14$

$$x - 12 + 12 = 14 + 12$$
$$x = 26$$

The solution is 26.

3. $3y - 2x - 7y - 9x$

$$= 3y + (-2x) + (-7y) + (-9x)$$
$$= 3y + (-7y) + (-2x) + (-9x)$$
$$= -4y + (-2x) + (-9x)$$
$$= -4y + (-11x)$$
$$= -4y - 11x = -11x - 4y$$

4. $8 - 3x = 2x - 8$

$$8 - 3x - 2x = 2x - 2x - 8$$
$$8 - 5x = -8$$
$$8 - 8 - 5x = -8 - 8$$
$$-5x = -16$$
$$\frac{-5x}{5} = \frac{-16}{-5}$$
$$x = \frac{16}{5}$$

The solution is $\frac{16}{5}$.

5. $3x - 12 = -18$

$3x - 12 + 12 = -18 + 12$

$3x = -6$

$\frac{3x}{3} = \frac{-6}{3}$

$x = -2$

The solution is -2.

6. $c^2 - (2a + b^2) = (-2)^2 - \left[2(3) + (-6)^2\right]$

$= 4 - (6 + 36)$

$= 4 - (42)$

$= 4 + (-42) = -38$

7. $x^2 + 3x - 7 = 3x - 2$

$3^2 + 3(3) - 7$	$3(3) - 2$
$9 + 9 - 7$	$9 - 2$
$18 - 7$	7
$11 \neq 7$	

No, 3 is not a solution.

8. $9 - 8ab - 6ab = 9 - 14ab = -14ab + 9$

9. $-5x = 14$

$\frac{-5x}{-5} = \frac{14}{-5}$

$x = -\frac{14}{5}$

The solution is $-\frac{14}{5}$.

10. $3y + 5(y - 3) + 8 = 3y + 5\left[y + (-3)\right] + 8$

$= 3y + 5y + 5(-3) + 8$

$= 8y + (-15) + 8$

$= 8y + (-7)$

$= 8y - 7$

11. $3x - 4(x - 2) = 8$

$3x - 4x + 8 = 8$

$-x + 8 = 8$

$-x + 8 - 8 = 8 - 8$

$-x = 0$

$(-1)(-x) = (-1)0$

$x = 0$

The solution is 0.

12. $5 = 3 - 4x$

$5 - 3 = 3 - 3 - 4x$

$2 = -4x$

$\frac{2}{-4} = \frac{-4x}{-4}$

$-\frac{1}{2} = x$

The solution is $-\frac{1}{2}$.

13. $\frac{x^2}{y} - \frac{y^2}{x} = \frac{3^2}{-2} - \frac{(-2)^2}{3}$

$= \frac{9}{-2} - \frac{4}{3}$

$= \frac{-27}{6} - \frac{8}{6}$

$= -\frac{35}{6}$

14. $\frac{5}{8}x = -10$

$\frac{8}{5} \cdot \frac{5}{8}x = \frac{8}{5}(-10)$

$x = -16$

The solution is -16.

15. $y - 4y + 3 = 12$

$-3y + 3 = 12$

$-3y + 3 - 3 = 12 - 3$

$-3y = 9$

$\frac{-3y}{-3} = \frac{9}{-3}$

$y = -3$

The solution is -3.

16. $2x + 4(x - 3) = 5x - 1$

$2x + 4x - 12 = 5x - 1$

$6x - 12 = 5x - 1$

$6x - 5x - 12 = 5x - 5x - 1$

$x - 12 = -1$

$x - 12 + 12 = -1 + 12$

$x = 11$

The solution is 11.

17. **Strategy** To find the monthly payment, replace the variables L and N in the formula by the given values and solve for P.

Solution

$$L = P \cdot N$$
$$6600 = P \cdot 48$$
$$\frac{6600}{48} = \frac{48P}{48}$$
$$137.50 = P$$

The monthly payment is \$137.50.

18. **Strategy** To find the number of clocks made during a month, replace the variables T, U, and F in the formula by the given values and solve for N.

Solution

$$T = U \cdot N + F$$
$$65{,}000 = 15N + 5000$$
$$65{,}000 - 5000 = 15N + 5000 - 5000$$
$$60{,}000 = 15N$$
$$\frac{60{,}000}{15} = \frac{15N}{15}$$
$$4000 = N$$

4000 clocks were made during the month.

19. **Strategy** To find the time, replace the variables V and V_0 in the formula by the given values and solve for t.

Solution

$$V = V_0 + 32t$$
$$392 = 24 + 32t$$
$$392 - 24 = 24 - 24 + 32t$$
$$368 = 32t$$
$$\frac{368}{32} = \frac{32t}{32}$$
$$11.5 = t$$

The object will fall for 11.5 s.

20. The *sum* of x and one-third of x

The unknown number: x

One-third of x: $\frac{1}{3}x$

$$x + \frac{1}{3}x$$

21. Five *times* the *sum* of a number and three

The unknown number: x

The sum of a number and three: $x + 3$

$5(x + 3)$

22. The unknown number: x

$$2x - 3 = 7$$
$$2x - 3 + 3 = 7 + 3$$
$$2x = 10$$
$$\frac{2x}{2} = \frac{10}{2}$$
$$x = 5$$

The number is 5.

23. The unknown number: w

$$5 + 3w = w - 2$$
$$5 + 3w - w = w - w - 2$$
$$5 + 2w = -2$$
$$5 - 5 + 2w = -2 - 5$$
$$2w = -7$$
$$\frac{2w}{2} = \frac{-7}{2}$$
$$w = -\frac{7}{2}$$

The number is $-\frac{7}{2}$.

24. **Strategy** To find Santos's total sales for the month, write and solve an equation using T to represent the total sales.

Solution

$3600	is	the sum of a base monthly salary of \$1200 and a 6% commission on total sales.

$$3600 = 1200 + 0.06T$$
$$3600 - 1200 = 1200 - 1200 + 0.06T$$
$$2400 = 0.06T$$
$$\frac{2400}{0.06} = \frac{0.06T}{0.06}$$
$$40{,}000 = T$$

Santos's total sales for the month were \$40,000.

25. **Strategy** To find the number of hours worked, write and solve an equation using h to represent the number of hours worked.

Solution

\$152 for parts plus \$62 per hour for labor	is	\$338.

$$152 + 62h = 338$$
$$152 - 152 + 62h = 338 - 152$$
$$62h = 186$$
$$h = 3$$

The mechanic worked for 3 h.

Cumulative Review Exercises

1. $6^2 - (18 - 6) \div 4 + 8 = 36 - (12) \div 4 + 8$
$= 36 - 3 + 8$
$= 33 + 8 = 41$

2. $3\frac{1}{6} = 3\frac{5}{30} = 2\frac{35}{30}$
$-1\frac{7}{15} = 1\frac{14}{30} = 1\frac{14}{30}$
$1\frac{21}{30} = 1\frac{7}{10}$

3. $\left(\frac{3}{8} - \frac{1}{4}\right) \div \frac{3}{4} + \frac{4}{9} = \left(\frac{3}{8} - \frac{2}{8}\right) \div \frac{3}{4} + \frac{4}{9}$
$= \frac{1}{8} \div \frac{3}{4} + \frac{4}{9}$
$= \frac{1}{8} \times \frac{4}{3} + \frac{4}{9}$
$= \frac{1}{6} + \frac{4}{9}$
$= \frac{3}{18} + \frac{8}{18} = \frac{11}{18}$

4.
$$\begin{array}{r} 9.67 \\ \times\ 0.0049 \\ \hline 8703 \\ 3868 \\ \hline 0.047383 \end{array}$$

5. $\dfrac{\$182}{20\,\text{h}} = \$9.10/\text{h}$

6. $\dfrac{2}{3} = \dfrac{n}{40}$

$2 \times 40 = 3 \cdot n$

$80 = 3 \cdot n$

$80 \div 3 = n$

$26.67 \approx n$

7. $5\dfrac{1}{3}\% = \dfrac{16}{3} \times \dfrac{1}{100} = \dfrac{16}{300} = \dfrac{4}{75}$

8. Percent × base = amount

$n \times 30 = 42$

$n = 42 \div 30$

$n = 1.40 = 140\%$

9. Percent × base = amount

$125\% \times n = 8$

$1.25 \times n = 8$

$n = 8 \div 1.25 = 6.4$

10. 3 ft 9 in.

$\times \qquad 5$

15 ft 45 in. = 18 ft 9 in.

11. $1\dfrac{3}{8}\ \text{lb} = \dfrac{11}{8}\ \cancel{\text{lb}} \times \dfrac{16\ \text{oz}}{1\ \cancel{\text{lb}}} = \dfrac{11 \cdot 16\ \text{oz}}{8} = 22\ \text{oz}$

12. 282 mg = 0.282g

13. $-2 + 5 + (-8) + 4 = 3 + (-8) + 4$

$= -5 + 4 = -1$

14. $13 - (-6) = 13 + 6 = 19$

15. $(-2)^2 - (-8) \div (3-5)^2$

$= (-2)^2 - (-8) \div (-2)^2$

$= 4 - (-8) \div 4$

$= 4 - (-2) = 4 + 2 = 6$

16. $3ab - 2ac = 3(-2)(6) - 2(-2)(-3)$

$= -36 - 12 = -36 + (-12) = -48$

17. $3z - 2x + 5z - 8x = 3z + (-2x) + 5z + (-8x)$

$= 3z + 5z + (-2x) + (-8x)$

$= 8z + (-10x)$

$= 8z - 10x = -10x + 8z$

18. $6y - 3(y - 5) + 8$

$= 6y + (-3)\big[y + (-5)\big] + 8$

$= 6y + (-3)y + (-3)(-5) + 8$

$= 6y + (-3y) + 15 + 8$

$= 3y + 23$

19. $2x - 5 = -7$

$2x - 5 + 5 = -7 + 5$

$2x = -2$

$2x = -2$

$\dfrac{2x}{2} = \dfrac{-2}{2}$

$x = -1$

The solution is -1.

20. $7x - 3(x - 5) = -10$

$7x - 3x + 15 = -10$

$4x + 15 = -10$

$4x + 15 - 15 = -10 - 15$

$4x = -25$

$\dfrac{4x}{4} = \dfrac{-25}{4}$

$x = -\dfrac{25}{4}$

The solution is $-\dfrac{25}{4}$.

21. $-\dfrac{2}{3}x = 5$

$\left(-\dfrac{3}{2}\right)\left(-\dfrac{2}{3}\right)x = -\dfrac{3}{2} \cdot 5$

$x = -\dfrac{15}{2}$

The solution is $-\dfrac{15}{2}$.

22. $\frac{x}{3} - 5 = -12$

$\frac{x}{3} - 5 + 5 = -12 + 5$

$\frac{x}{3} = -7$

$3 \cdot \frac{x}{3} = 3(-7)$

$x = -21$

The solution is -21.

23. **Strategy** To find the percent of the students who received an A grade, solve the basic percent equation for percent.

Solution Percent · base = amount

$n \cdot 34 = 6$

$n = 6 \div 34$

$n \approx 0.176 = 17.6\%$

The percent is 17.6%.

24. **Strategy** To find the price:

• Find the amount of the markup by solving the basic percent equation for amount. The base is \$28.50 and the percent is 40%.

• Add the amount of the markup to the cost.

Solution $0.40 \times 28.50 = n$

$11.40 = n$

$$\begin{array}{r} 28.50 \\ +11.40 \\ \hline 39.90 \end{array}$$

The price of the piece of pottery is \$39.90.

25a. **Strategy** To find the discount subtract the sale price (\$369) from the regular price (\$450).

Solution 450 – 369 = 81

The discount is \$81.

b. **Strategy** To find the discount rate, write and solve the basic percent equation for percent. The base is the regular price and the amount is the discount.

Solution Percent × base = amount

$n \times 450 = 81$

$n = 81 \div 450$

$n = 0.18$

The discount rate is 18%.

26. **Strategy** To find the simple interest due, multiply the principal and rate and time (in years).

Solution

$$\text{Interest} = 80{,}000 \times 11\% \times \frac{4}{12}$$

$$= 80{,}000 \times 0.11 \times \frac{4}{12}$$

$$\approx 2933.33$$

The simple interest due on the loan is \$2933.33.

27. **Strategy** To find the number of people, write and solve a basic percent equation using p to represent the number of people who participated in the survey. The amount is 797 and the percent is 35%.

Solution

35% of the number of people surveyed	is	797 people.

$$\text{Percent} \times \text{base} = \text{amount}$$
$$35\% \cdot p = 797$$
$$0.35p = 797$$
$$\frac{0.35p}{0.35} = \frac{797}{0.35}$$
$$p \approx 2277$$

2277 people participated in the survey.

28. **Strategy** To calculate the probability:

- Count the number of possible outcomes.
- Count the number of favorable outcomes.
- Use the probability formula.

Solution There are 16 possible outcomes.

There are 2 favorable outcomes: (3, 4), (4, 3).

$$\text{Probability} = \frac{2}{16} = \frac{1}{8}$$

The probability is $\frac{1}{8}$ that the sum of the upward faces on the two dice is 7.

29. **Strategy** To find the total sales, replace the variables M, R, and B in the formula with the given values and solve for S.

Solution
$$M = SR + B$$
$$3400 = S \cdot 0.08 + 800$$
$$3400 - 800 = S \cdot 0.08 + 800 - 800$$
$$2600 = S \cdot 0.08$$
$$\frac{2600}{0.08} = \frac{S \cdot 0.08}{0.08}$$
$$32{,}500 = S$$

The total sales were \$32,500.

30. The unknown number: x

$$\begin{aligned}
8x - 3 &= 3 + 5x \\
8x - 5x - 3 &= 3 + 5x - 5x \\
3x - 3 &= 3 \\
3x - 3 + 3 &= 3 + 3 \\
3x &= 6 \\
\frac{3x}{3} &= \frac{6}{3} \\
x &= 2
\end{aligned}$$

The number is 2.

Chapter 12: Geometry

Prep Test

1. $x + 47 = 90$
$x + 47 - 47 = 90 - 47$
$x = 43$

The solution is 43.

2. $32 + 97 + x = 180$
$129 + x = 180$
$129 - 129 + x = 180 - 129$
$x = 51$

The solution is 51.

3. $2(18) + 2(10) = 36 + 20 = 56$

4. abc
$= (2)(3.14)(9)$
$= (6.28)(9)$
$= 56.52$

5. xyz^3
$= \left(\frac{4}{3}\right)(3.14)(3)^3$
$= 113.04$

6. $\frac{5}{12} = \frac{6}{x}$
$5x = 12 \times 6$
$\frac{5x}{5} = \frac{72}{5}$
$x = 14.4$

The solution is 14.4.

Section 12.1

Concept Check

1. 0°; 90°

3. 180°

5. Perpendicular

7. Hypotenuse

Objective A Exercises

9. $EG = EF + FG$
$EG = 20 + 10 = 30$

11. $QS = QR + RS$
$28 = 7 + RS$
$28 - 7 = 7 - 7 + RS$
$21 = RS$

13. $AD = AB + BC + CD$
$35 = 12 + BC + 9$
$35 = 21 + BC$
$35 - 21 = 21 - 21 + BC$
$14 = BC$

15. Let x represent the complement of 31°. The sum of complementary angles is 90°.

$x + 31° = 90°$
$x + 31° - 31° = 90° - 31°$
$x = 59°$

59° is the complement of 31°.

17. Let x represent the supplement of 72°. The sum of supplementary angles is 180°.

$x + 72° = 180°$
$x + 72° - 72° = 180° - 72°$
$x = 108°$

108° is the supplement of 72°.

19. Let x represent the complement of 13°. The sum of complementary angles is 90°.

$x + 13° = 90°$
$x + 13° - 13° = 90° - 13°$
$x = 77°$

77° is the complement of 13°.

21. Let x represent the supplement of 127°. The sum of supplementary angles is 180°.

$$\begin{aligned} x + 127° &= 180° \\ x + 127° - 127° &= 180° - 127° \\ x &= 53° \end{aligned}$$

53° is the supplement of 127°.

23. An acute angle

25. An obtuse angle

27. $\angle AOB = 32° + 45° = 77°$

29.
$$\begin{aligned} 42° + \angle a &= 160° \\ 42° - 42° + \angle a &= 160° - 42° \\ \angle a &= 118° \end{aligned}$$

31.
$$\begin{aligned} \angle a + 47° &= 180° \\ \angle a + 47° - 47° &= 180° - 47° \\ \angle a &= 133° \end{aligned}$$

33.
$$\begin{aligned} \angle LON &= \angle LOM + \angle MON \\ 139° &= 53° + \angle MON \\ 139° - 53° &= 53° - 53° + \angle MON \\ 86° &= \angle MON \end{aligned}$$

Objective B Exercises

35. Square

37. Circle

39. The sum of the three angles of a triangle is 180°.

$$\begin{aligned} \angle A + \angle B + \angle C &= 180° \\ \angle A + \angle 13° + \angle 65° &= 180° \\ \angle A + 78° &= 180° \\ \angle A + 78° - 78° &= 180° - 78° \\ \angle A &= 102° \end{aligned}$$

The measure of the other angle is 102°.

41. In a right triangle, one angle measures 90° and the two acute angles are complementary.

$$\begin{aligned} \angle A + \angle B &= 90° \\ \angle A + 45° &= 90° \\ \angle A + 45° - 45° &= 90° - 45° \\ \angle A &= 45° \end{aligned}$$

The other angles measure 90° and 45°.

43. The sum of the three angles of a triangle is 180°.

$$\begin{aligned} \angle A + \angle B + \angle C &= 180° \\ \angle A + 62° + 104° &= 180° \\ \angle A + 166° &= 180° \\ \angle A + 166° - 166° &= 180° - 166° \\ \angle A &= 14° \end{aligned}$$

The measure of the other angle is 14°.

45. In a right triangle, one angle measures 90° and the two acute angles are complementary.

$$\begin{aligned} \angle A + \angle B &= 90° \\ \angle A + 25° &= 90° \\ \angle A + 25° - 25° &= 90° - 25° \\ \angle A &= 65° \end{aligned}$$

The other angles measure 90° and 65°.

47. $r = \frac{1}{2}d$

$$r = \frac{1}{2}(16 \text{ in.}) = 8 \text{ in.}$$

The radius is 8 in.

49. $d = 2r$

$$d = 2\left(2\frac{1}{3} \text{ ft}\right)$$

$$d = 2\left(\frac{7}{3} \text{ ft}\right)$$

$$d = \frac{14}{3} \text{ ft} = 4\frac{2}{3} \text{ ft}$$

The diameter is $4\frac{2}{3}$ ft.

51. $d = 2r$

$d = 2(3.5 \text{ cm}) = 7 \text{ cm}$

The diameter is 7 cm.

53. $r = \frac{1}{2}d$

$r = \frac{1}{2}(4 \text{ ft } 8 \text{ in.})$

$r = 2 \text{ ft } 4 \text{ in.}$

The radius is 2 ft 4 in.

55. False

57. True

Objective C Exercises

59.

$\angle a + 49° = 180°$ supplementary angles

$\angle a + 49° - 49° = 180° - 49°$

$\angle a = 131°$

$\angle b = 49°$ vertical angle

61.

$\angle a = 131°$ vertical angle

$\angle b + 131° = 180°$ supplementary angles

$\angle b + 131° - 131° = 180° - 131°$

$\angle b = 49°$

63.

$\angle b + 136° = 180°$ supplementary angles

$\angle b + 136° - 136° = 180° - 136°$

$\angle b = 44°$

$\angle a = \angle b$ corresponding angles

$\angle a = 44°$

65.

$\angle a = 55°$ alternate interior angles

$\angle a + \angle b = 180°$ supplementary angles

$55° + \angle b = 180°$

$55° - 55° + \angle b = 180° - 55°$

$\angle b = 125°$

67.

$\angle b = 75°$ alternate exterior angles

$\angle a + \angle b = 180°$ supplementary angles

$\angle a + 75° = 180°$

$\angle a + 75° - 75° = 180° - 75°$

$\angle a = 105°$

69.

$\angle b = 118°$ corresponding angles

$\angle a + \angle b = 180°$ supplementary angles

$\angle a + 118° = 180°$

$\angle a + 118° - 118° = 180° - 118°$

$\angle a = 62°$

71. True

Critical Thinking

73. $\angle AOC$ and $\angle BOC$ are supplementary angles. Therefore, $\angle AOC + \angle BOC = 180°$.

Because $\angle AOC = \angle BOC$, by substitution $\angle AOC + \angle AOC = 180°$. Therefore, $2\angle AOC = 180°$ and $\angle AOC = 90°$. Therefore, *AB* is perpendicular to *CD*.

Section 12.2

Concept Check

1a. triangle

b. hexagon

c. rhombus, square

d. two

3. $P = 2L + 2W$

Objective A Exercises

5. $P = a + b + c$
$= 12 \text{ in.} + 20 \text{ in.} + 24 \text{ in.}$
$= 56 \text{ in.}$

The perimeter of the triangle is 56 in.

7. $P = 4s$
$= 4(5 \text{ ft})$
$= 20 \text{ ft}$

The perimeter or the square is 20 ft.

9. $C = \pi d$
$\approx 3.14(15 \text{ cm})$
$= 47.1 \text{ cm}$

The circumference of the circle is approximately 47.1 cm.

11. $P = 2L + 2W$
$= 2(32 \text{ cm}) + 2(14 \text{ cm})$
$= 64 \text{ cm} + 28 \text{ cm}$
$= 92 \text{ cm}$

The perimeter of the rectangle is 92 cm.

13. $P = 2 \text{ ft } 4 \text{ in.} + 3 \text{ ft} + 4 \text{ ft } 6 \text{ in.}$
$= 9 \text{ ft } 10 \text{ in.}$

The perimeter of the triangle is 9 ft 10 in.

15. $C = 2\pi r$
$\approx 2(3.14)(8 \text{ cm})$
$= 50.24 \text{ cm}$

The circumference of the circle is approximately 50.24 cm.

17. $P = 4s$
$= 4(60 \text{ m})$
$= 240 \text{ m}$

The perimeter of the square is 240 m.

19. **Strategy** To find the amount of fencing, find the perimeter of the corral using the width (60 ft) and the length (75 ft).

Solution $P = 2L + 2W$
$= 2(75 \text{ ft}) + 2(60 \text{ ft})$
$= 150 \text{ ft} + 120 \text{ ft}$
$= 270 \text{ ft}$

The trainer will need 270 ft of fencing.

21. The perimeter of the square is greater.

Objective B Exercises

23.

Perimeter = sum of the length of the sides
$= 19 \text{ cm} + 20 \text{ cm} + 8 \text{ cm} + 5 \text{ cm} + 27 \text{ cm} + 42 \text{ cm}$
$= 121 \text{ cm}$

The perimeter is 121 cm.

25.

Perimeter of Composite Figure = 3 sides of a rectangle + $\frac{1}{2}$ the circumference of a circle

$= 2L + W + \frac{1}{2}\pi d$
$\approx 2(15 \text{ m}) + 8 \text{ m} + \frac{1}{2}(3.14)(8 \text{ m})$
$= 30 \text{ m} + 8 \text{ m} + 12.56 \text{ m}$
$= 50.56 \text{ m}$

The perimeter is 50.56 m.

27. Perimeter = length of two sides

$$+\frac{1}{2}\text{ circumference of circle}$$

$$= 2 \cdot 1 \text{ ft} + \frac{1}{2}(3.14 \cdot 1 \text{ ft})$$

$$= 2 \text{ ft} + 1.57 \text{ ft}$$

$$= 3.57 \text{ ft}$$

The perimeter is 3.57 ft.

29. Perimeter

= sum of the length of the six sides of figure

$$= 22.75 \text{ m} + 25.73 \text{ m} + 15.94 \text{ m} + 18.3 \text{ m} + 21.61 \text{ m} + 34.97 \text{ m}$$

$$= 139.3 \text{ m}$$

The perimeter is 139.3 m.

31. Less than

Objective C Exercises

33. **Strategy** To find the amount of fencing, use the formula for the perimeter of a rectangle.

Solution $P = 2L + 2W = 2 \cdot 18 + 2 \cdot 12 = 36 + 24 = 60$

The amount of fencing needed is 60 ft.

35. **Strategy** To find the amount of binding, find the perimeter of a rectangle.

Solution $P = 2L + 2W = 2 \cdot 8.5 + 2 \cdot 3.5 = 17 + 7 = 24$

The amount of binding needed is 24 ft.

37. **Strategy** To find the circumference of the track, use the formula for the circumference of a circle.

Solution $C = 2\pi r$

$$\approx 2 \cdot 3.14 \cdot 157.64 \text{ ft}$$

$$\approx 990 \text{ ft}$$

The circumference of the track is approximately 990ft.

39. **Strategy** To find the amount of bias binding:

- Use the formula for the perimeter of a rectangle to find the amount of binding needed.
- Convert the amount to feet.
- Divide the amount by 15 to find the number of packages needed.

Solution $P = 2L + 2W + = 2 \cdot 72 + 2 \cdot 45 = 144 + 90 = 234$

$234 \text{ in.} = 19.5 \text{ ft}$

$19.5 \div 15 = 1.3$

Since 1.3 packages are needed, 2 packages must be ordered.

41. **Strategy** To find the distance the tricycle travels:

- Convert the diameter (12 in.) to feet.
- Use the formula for circumference to find the distance traveled in 1 revolution.
- Multiply the distance traveled in 1 revolution by the number of revolutions (8).

Solution $12 \cancel{\text{in.}} \times \frac{1 \text{ ft}}{12 \cancel{\text{in.}}} = 1 \text{ ft}$

$C = \pi d$

$$\approx 3.14 \cdot 1 = 3.14 \text{ ft}$$

$3.14 \text{ ft} \times 8 = 25.12 \text{ ft}$

The bicycle travels 25.12 ft.

43. **Strategy** To find the perimeter of the roller rink, find the perimeter of the composite figure.

Solution

Perimeter

= sum of length of two sides

+ 2 times $\frac{1}{2}$ circumference of a circle

$\approx 2 \cdot 25 + 2 \cdot \frac{1}{2}(3.14 \cdot 10)$

$= 50 + 31.4 = 81.4$

The perimeter of the rink is 81.4 m.

45. **Strategy** To find the length of weather stripping, find the perimeter of the composite figure.

Solution

Perimeter

= sum of three sides of rectangle

$+ \frac{1}{2}$ circumference of a circle

$\approx (3 \text{ ft}) + (2 \cdot 6 \text{ ft } 6 \text{ in.}) + \frac{1}{2}(3.14 \cdot 3 \text{ ft})$

$= 3 \text{ ft} + 13 \text{ ft} + 4.71 \text{ ft} = 20.71 \text{ ft}$

Approximately 20.71 ft of weather stripping are installed.

Critical Thinking

47a. Two times; If the diameter is 1 ft, then $C = \pi$. If the diameter is 2 ft, then $C = 2\pi$.

b. Two times; If the radius is 1 ft, then $C = 2\pi$. If the radius is 2 ft, then $C = 4\pi$.

49. The ranger could measure the circumference of the trunk of the tree and then solve the equation $C = \pi d$ for *d*.

Section 12.3

Concept Check

1a. $A = LW$

b. $A = \pi r^2$

Objective A Exercises

3. $A = LW = 24 \text{ ft} \cdot 6 \text{ ft} = 144 \text{ ft}^2$

5. $A = s^2 = (9 \text{ in.})^2 = 81 \text{ in}^2$

7. $A = \pi r^2$

$\approx 3.14(4 \text{ ft})^2 = 50.24 \text{ ft}^2$

9. $A = \frac{1}{2}bh$

$= \frac{1}{2} \cdot (10 \text{ in.})(4 \text{ in.}) = 20 \text{ in}^2$

11. $A = \frac{1}{2}bh$

$= \frac{1}{2} \cdot 3 \text{ cm} \cdot 1.42 \text{ cm} = 2.13 \text{ cm}^2$

13. $A = s^2 = 4 \text{ ft} \cdot 4 \text{ ft} = 16 \text{ ft}^2$

15. $A = LW = 43 \text{ in.} \cdot 19 \text{ in.} = 817 \text{ in}^2$

17. $A = \pi r^2 \approx \frac{22}{7} \cdot 7 \text{ in.} \cdot 7 \text{ in.} = 154 \text{ in}^2$

19. **Strategy** To find the area, replace *s* in the formula $A = s^2$ with the length of a side if the square (90 ft).

Solution $A = s^2$

$= (90 \text{ ft})^2$

$= 8100 \text{ ft}^2$

The baseball field has an area of 8100 ft^2.

21. Equal to; each area is equal to $\frac{1}{2}xy$.

Objective B Exercises

23. Area = area of rectangle − area of triangle

$$= (LW) - \left(\frac{1}{2}bh\right)$$
$$= (8 \text{ cm} \cdot 4 \text{ cm}) - \left(\frac{1}{2} \cdot 4 \text{ cm} \cdot 3 \text{ cm}\right)$$
$$= 32 \text{ cm}^2 - 6 \text{ cm}^2$$
$$= 26 \text{ cm}^2$$

25. Area = area of rectangle − area of triangle

$$= (LW) - \left(\frac{1}{2}bh\right)$$
$$= (80 \text{ cm} \cdot 30 \text{ cm}) - \left(\frac{1}{2} \cdot 30 \text{ cm} \cdot 12 \text{ cm}\right)$$
$$= 2400 \text{ cm}^2 - 180 \text{ cm}^2$$
$$= 2220 \text{ cm}^2$$

27. Area = area of circle $- \frac{1}{4}$ area of circle

$$= \pi r^2 - \frac{1}{4} \cdot \pi r^2$$
$$\approx 3.14(8 \text{ in.})^2 - \frac{1}{4} \cdot 3.14(8 \text{ in.})^2$$
$$= 200.96 \text{ in}^2 - 50.24 \text{ in}^2$$
$$= 150.72 \text{ in}^2$$

29. Area = area of rectangle $- \frac{1}{2}$ area of circle

$$= LW - \frac{1}{2} \cdot \pi r^2$$
$$\approx 4.38 \text{ ft} \cdot 3.74 \text{ ft} - \frac{1}{2} \cdot 3.14(2.19 \text{ ft})^2$$
$$= 16.3812 \text{ ft}^2 - 7.529877 \text{ ft}^2$$
$$= 8.851323 \text{ ft}^2$$

31. Equal to

Objective C Exercises

33. Strategy To find the area of the playing field, find the area of a rectangle with length 100 yd and width 75 yd.

Solution
$$A = LW$$
$$= 100 \text{ yd} \cdot 75 \text{ yd}$$
$$= 7500 \text{ yd}^2$$

The area of the playing field is 7500 yd^2.

35. Strategy To find the amount of stain:

- Find the area of a rectangle that measures 10 ft by 8 ft.
- Divide the area by the area that one quart of stain will cover (50 ft^2).

Solution
$$A = LW$$
$$= 10 \text{ ft} \cdot 8 \text{ ft}$$
$$= 80 \text{ ft}^2$$
$$80 \text{ ft}^2 \div 50 \text{ ft}^2 = 1.6$$

It will take 1.6 quarts of stain. You should buy 2 qt.

37. Strategy To find the area of the field, find the area of a circle with a radius of 50 ft.

Solution
$$A = \pi r^2 \approx 3.14 \cdot 50 \text{ ft} \cdot 50 \text{ ft}$$
$$= 7850 \text{ ft}^2$$

The area watered by the irrigation system is approximately 7850 ft^2.

39. No

41. Yes

43. Strategy To find the cost of the carpet:

- Find the area of the room and hallway. The total area is the sum of the areas of the two rectangles.
- Multiply the total area by \$28.50.

Solution

$$\begin{aligned}\text{Area} &= 6.8 \cdot 4.5 + (10.8 - 6.8) \cdot 1 \\ &= 30.6 + 4 \cdot 1 \\ &= 30.6 + 4 \\ &= 34.6\end{aligned}$$

$$\text{Cost} = (34.6)(28.50) = 986.10$$

The cost of the carpet is \$986.10.

45. Strategy To find the number of tiles to be purchased.

- Use the formula for the area of rectangle to find the area of the kitchen floor.
- Divide the area of the kitchen floor by the area of one tile $\left(1\frac{1}{2}\text{ ft}\right)^2$.

Solution

$$\begin{aligned}A &= LW \\ &= 12 \text{ ft} \cdot 9 \text{ ft} \\ &= 108 \text{ ft}^2\end{aligned}$$

$$108 \text{ ft}^2 \div \left(1\frac{1}{2} \text{ ft}\right)^2 = 108 \div \frac{9}{4}$$

$$= 108 \cdot \frac{4}{9} = 48$$

You should purchase 48 tiles for your kitchen floor.

47. Strategy To find the area of the boundary, subtract the area of the rectangular swimming pool from the area of the swimming pool and boundary.

Solution

$$\begin{aligned}\text{Area} &= \text{area of swimming pool and boundary} \\ &\quad - \text{area of swimming pool} \\ &= (\text{length} \cdot \text{width}) - (\text{length} \cdot \text{width}) \\ &= (9 \text{ m} \cdot 12 \text{ m}) - (8 \text{ m} \cdot 5 \text{ m}) \\ &= 108 \text{ m}^2 - 40 \text{ m}^2 \\ &= 68 \text{ m}^2\end{aligned}$$

The area of the boundary around the pool is 68 m^2.

49a. Strategy To determine whether the area is more or less than 8000 ft^2:

- Assume that the area is a rectangle with dimensions 175 ft by 80 ft.
- Find the area and compare with 8000 ft^2.

Solution

$$\begin{aligned}A &= LW \\ &= 175 \text{ ft} \cdot 80 \text{ ft} \\ &= 14,000\end{aligned}$$

Since the area of the rink is greater than 14,000 ft^2 it is more than 8000 ft^2.

b. Strategy To find how much hardwood floor is needed, find the area of the composite figure.

Solution

$$\begin{aligned}\text{Area} &= \text{area of rectangle} \\ &\quad + 2 \text{ times } \frac{1}{2} \text{ area of circle} \\ &= (LW) + 2\left(\frac{1}{2}\pi r^2\right) \\ &\approx (175 \text{ ft} \cdot 80 \text{ ft}) + \frac{1}{2} \cdot 3.14(40 \text{ ft})^2 \\ &= 14,000 \text{ ft}^2 + 5024 \text{ ft}^2 \\ &= 19,024 \text{ ft}^2\end{aligned}$$

To cover the rink, approximately $19,024 \text{ ft}^2$ of hardwood floor is needed.

51. Strategy To find the cost to plaster the room:

- Find the area of the two walls 25 ft 6 in. long and 8 ft high.
- Find the area of the two

walls 22 ft long and 8 ft high.

• Add to find the area of the four walls.

• Subtract 120 ft^2 from the area of the four walls.

• Multiply the area by the cost per square foot ($3.00).

Solution

$2 \cdot 25.5 \text{ ft} \cdot 8 \text{ ft} = 408 \text{ ft}^2$
(area of two walls)

$2 \cdot 22 \text{ ft} \cdot 8 \text{ ft} = 352 \text{ ft}^2$
(area of two walls)

$408 \text{ ft}^2 + 352 \text{ ft}^2 = 760 \text{ ft}^2$
(area of four walls)

$760 \text{ ft}^2 - 120 \text{ ft}^2 = 640 \text{ ft}^2$
(area of walls minus doors and windows)

$640 \text{ ft}^2 \times 3 = 1920$

The cost to plaster the room is $1920.

Critical Thinking

53. The area in the circles to the left of the line is equal to the area in the circles to the right of the line. Note that in the circle at the left in the top row, the line goes through the center of the circle; thus it is a diameter of the circle, and half the area lies on one side of the line and half lies on the other side of the line. A complete circle lies on each side of the line; the circle at the right in the top row is on one side, and the circle at the left in the bottom row lies on the other side. For the two circles at the right on the bottom row, half their combined area lies on the left side of the line, and half lies on the right side of the line.

Projects or Group Activities

55. Strategy To find the total area:

- Find the area of each individual trapezoid using the formula for the area of a trapezoid.
- Add the areas of the trapezoids.

Solution Area of a trapezoid

$$= \frac{1}{2}(B + b)h$$

$$A_1 = \frac{1}{2}(8.4 + 9.2)2.75$$
$$= 24.2$$

$$A_2 = \frac{1}{2}(9.2 + 9.8)2.75$$
$$= 26.125$$

$$A_3 = \frac{1}{2}(9.8 + 11.1)2.75$$
$$= 28.7375$$

$$A_4 = \frac{1}{2}(11.1 + 11.3)2.75$$
$$= 30.8$$

$$A_5 = \frac{1}{2}(11.3 + 12)2.75$$
$$= 32.0375$$

$$A_6 = \frac{1}{2}(12 + 10.3)2.75$$
$$= 30.6625$$

$$A_7 = \frac{1}{2}(10.3 + 9.0)2.75$$
$$= 26.5375$$

$$A_8 = \frac{1}{2}(9.0 + 7.8)2.75$$
$$= 23.1$$

Total area =24.2 + 26.125
+ 28.7375 + 30.8 + 32.0375
+ 30.6625 + 26.5375
+ 23.1=222.2

The area of Lake Tahoe is approximately 222.2 mi^2.

Check Your Progress: Chapter 12

1. $MP = MN + NO + OP$

$72 = 20 + 24 + OP$

$72 = 44 + OP$

$27 - 44 = 44 - 44 + OP$

$28 = OP$

2. Let x represent the complement of $27°$. The sum of complementary angles is $90°$.

$x + 27° = 90°$

$x + 27° - 27° = 90° - 27°$

$x = 63°$

$63°$ is the complement of $\angle A$.

Let x represent the supplement of $27°$. The sum of complementary angles is $180°$.

$x + 27° = 180°$

$x + 27° - 27° = 180° - 27°$

$x = 153°$

$153°$ is the supplement of $\angle A$.

3. $a + 50° = 118°$

$a + 50° - 50° = 118° - 50°$

$a = 68°$

4. $\angle a = \angle c = 120°$

$\angle b + \angle c = 180°$

$\angle b + 120° = 180°$

$\angle b = 60°$

5. In a right triangle, one angle measures $90°$ and the two acute angles are complementary.

$\angle A + \angle B = 90°$

$\angle A + 22° = 90°$

$\angle A + 22° - 22° = 90° - 22°$

$\angle A = 68°$

The other angles measure $90°$ and $68°$.

6. The sum of the three angles of a triangle is $180°$.

$\angle A + \angle B + \angle C = 180°$

$\angle A + 54° + 112° = 180°$

$\angle A + 166° = 180°$

$\angle A + 166° - 166° = 180° - 166°$

$\angle A = 14°$

7. $\angle LOM + \angle MON = \angle LON$

$\angle LOM + 86° = 139°$

$\angle LOM + 86° - 86° = 139° - 86°$

$\angle LOM = 53°$

8. $\angle b = 50°$

$\angle a + \angle b = 180°$

$\angle a + 50° = 180°$

$\angle a + 50° - 50° = 180° - 50°$

$\angle a = 130°$

9. $P = 2L + 2W$

$= 2(3.25 \text{ m}) + 2(75 \text{ cm})$

$= 2(3.25 \text{ m}) + 2(75 \text{ cm})\left(\frac{1 \text{ m}}{100 \text{ cm}}\right)$

$= 6.5 \text{ m} + 1.5 \text{ m}$

$= 8 \text{ m}$

10. $C = 2\pi r$

$\approx 2(3.14)(3.6 \text{ in.})$

$= 22.608 \text{ in.}$

11. $P = 2L + W + \frac{1}{2}\pi d$

$\approx 2(2 \text{ m}) + 0.8 \text{ m} = \frac{1}{2}(3.14)(0.8 \text{ m})$

$= 4 \text{ m} + 0.8 \text{ m} + 1.256 \text{ m}$

$= 6.056 \text{ m}$

12. $A = \frac{1}{2}bh$

$= \frac{1}{2}(4 \text{ m})(3 \text{ m})$

$= 6 \text{ m}^2$

13. $r = \frac{1}{2}d = \frac{1}{2}(6 \text{ in.}) = 3 \text{ in.}$

$A = \pi r^2$

$\approx 3.14(3 \text{ in.})^2$

$= 28.26 \text{ in}^2$

14. $r = \frac{1}{2}d = \frac{1}{2}(4 \text{ cm}) = 2 \text{ cm}$

$A = s^2 + 2\pi r^2$

$\approx (4 \text{ cm})^2 + 2(3.14)(2 \text{ cm})^2$

$= 16 \text{ cm}^2 + 25.12 \text{ cm}^2$

$= 41.12 \text{ cm}^2$

15. **Strategy** To find the cost of the carpet:

• Find the area of the floor in square feet..

• Multiply the square footage of the floor by the cost per square foot of the carpet.

Solution $A = LW$

$= (14 \text{ ft})(12 \text{ ft})$

$= 168 \text{ ft}^2$

$168 \text{ ft}^2 \cdot \frac{\$3.25}{\text{ft}^2} = \$546$

The carpet costs $546.

16. **Strategy** To find the area:

• Find the area of the garden.

• Find the total area of the garden and the walkway.

• Subtract the area of the garden from the total area.

Solution $A = \pi^2$

$\approx 3.14(10 \text{ ft})^2$

$= 314 \text{ ft}^2$

The area of the garden is 314 ft^2.

$A = \pi^2$

$\approx 3.14(10 \text{ ft} + 5 \text{ ft})^2$

$= 3.14(15 \text{ ft})^2$

$= 706.5 \text{ ft}^2$

The total area of the garden and the walkway is 706.5 ft^2.

$706.5 \text{ ft}^2 - 314 \text{ ft}^2 = 392.5 \text{ ft}^2$

The area of the walkway is 392.5 ft^2.

Section 12.4

Concept Check

1a. $V = s^3$

b. $V = \frac{4}{3}\pi r^3$

c. $V = \pi r^2 h$

Objective A Exercises

3. $V = LWH$

$= 12 \text{ cm} \cdot 4 \text{ cm} \cdot 3 \text{ cm} = 144 \text{ cm}^3$

5. $V = s^3 = (8 \text{ in.})^3 = 512 \text{ in}^3$

7. $V = \frac{4}{3}\pi r^3 \approx \frac{4}{3}(3.14)(8 \text{ in.})^3$

$\approx 2143.57 \text{ in}^3$

9. $V = \pi r^2 h$

$\approx 3.14(2 \text{ cm})^2 \cdot 12 \text{ cm} = 150.72 \text{ cm}^3$

11. $V = LWH$

$= 2 \text{ m} \cdot 0.8 \text{ m} \cdot 4 \text{ m} = 6.4 \text{ m}^3$

13. $V = \frac{4}{3}\pi r^3$

$\approx \frac{4}{3} \cdot 3.14(11 \text{ mm})^3$

$\approx 5572.45 \text{ mm}^3$

15. $r = \frac{1}{2}d = \frac{1}{2} \cdot 12 \text{ ft} = 6 \text{ ft}$

$V = \pi r^2 h$

$\approx 3.14(6 \text{ ft})^2 (30 \text{ ft})$

$= 3391.2 \text{ ft}^3$

17. $V = s^3$

$$= 3\frac{1}{2}\text{ ft} \cdot 3\frac{1}{2}\text{ ft} \cdot 3\frac{1}{2}\text{ ft} = 42\frac{7}{8}\text{ ft}^3$$

19. The sphere has the greater volume.

Objective B Exercises

21. Volume $= \frac{1}{2}$ volume of cylinder + volume of rectangular solid

$$= \left[\frac{1}{2} \cdot \pi(\text{radius})^2 \cdot \text{height}\right] + (\text{length} \cdot \text{width} \cdot \text{height})$$

$$\approx \left(\frac{1}{2} \cdot 3.14 \cdot 3\text{ in.} \cdot 3\text{ in.} \cdot 2\text{ in.}\right) + (6\text{ in.} \cdot 9\text{ in.} \cdot 1\text{ in.}) = 28.26\text{ in}^3 + 54\text{ in}^3 = 82.26\text{ in}^3$$

23. Volume = volume of rectangular solid − volume of cylinder $= (\text{length} \cdot \text{width} \cdot \text{height})$

$$-\left[\pi(\text{radius})^2 \cdot \text{height}\right]$$

$$\approx (1.20\text{ m} \cdot 2\text{ m} \cdot 0.80\text{ m}) - (3.14 \cdot 0.20\text{ m} \cdot 0.20\text{ m} \cdot 2\text{ m})$$

$$= 1.92\text{ m}^3 - 0.2512\text{ m}^3 = 1.6688\text{ m}^3$$

25. Volume = volume of cylinder + volume of cylinder

$$= \left[\pi(\text{radius})^2 \cdot \text{height}\right] + \left[\pi(\text{radius})^2 \cdot \text{height}\right]$$

$$\approx (3.14 \cdot 3\text{ in.} \cdot 3\text{ in.} \cdot 2\text{ in.}) + (3.14 \cdot 1\text{ in.} \cdot 1\text{ in.} \cdot 4\text{ in.})$$

$$= 56.52\text{ in}^3 + 12.56\text{ in}^3 = 69.08\text{ in}^3$$

27. The volume will increase.

Objective C Exercises

29. **Strategy** To find the volume of the tank, use the formula for the volume of a rectangular solid.

Solution $V = LWH$

$$= 9\text{ m} \cdot 3\text{ m} \cdot 1.5\text{ m}$$

$$= 40.5\text{ m}^3$$

The volume of the water in the tank is 40.5 m^3.

31. **Strategy** To find the volume of the balloon, use the formula for the volume of a sphere.

Solution $V = \frac{4}{3}\pi r^3$

$$\approx \frac{3}{4} \cdot 3.14\,(16\text{ ft})^3$$

$$\approx 17{,}148.59\text{ ft}^3$$

The volume is approximately $17{,}148.59\text{ ft}^3$.

33. **Strategy** To find the volume not used for storage:

• Use the formula for the volume of a cylinder to find the volume of the silo.

• Multiply the volume of the silo by $\frac{1}{4}$ to find the volume not used for storage.

Solution

$$V = \pi r^2 h$$
$$\approx 3.14(8 \text{ ft})^2 (30 \text{ ft})$$
$$= 6028.80 \text{ ft}^3$$

$$\text{Amount not used} = \frac{1}{4} \cdot 6028.80 \text{ ft}^3$$
$$\approx 1507.2 \text{ ft}^3$$

Approximately 1507.2 ft^3 of the silo is not used for storage.

35. **Strategy** To find the number of people that could be fed:

- Multiply the volume of the guacamole (found in Exercise 34) by 59.84 to find the number of pints of guacamole.
- Convert from pints to cups by multiplying by 2.

Solution

$$172{,}800 \text{ ft}^3 \times \frac{59.84 \text{ pt}}{1 \text{ ft}^3}$$
$$= 10{,}340{,}352 \text{ pt}$$
$$10{,}340{,}352 \text{ pt} \times \frac{2 \text{ c}}{1 \text{ pt}}$$
$$= 20{,}680{,}704 \text{ c}$$

20,680,704 people could be fed.

37. **Strategy** To find the number of gallons:

- Find the volume of the water in the lock.
- Multiply the volume by 7.48 gal/ft^3.

Solution

$$V = LWH$$
$$= 1000 \text{ ft} \cdot 110 \text{ ft} \cdot 43 \text{ ft}$$
$$= 4{,}730{,}000 \text{ ft}^3$$

$$4{,}730{,}000 \text{ ft}^3 \times \frac{7.48 \text{ gal}}{\text{ft}^3}$$
$$= 35{,}380{,}400 \text{ gal}$$

There are 35,380,400 gallons of water in the lock.

39. **Strategy** To find the volume of the bushing, subtract the volume of the half-cylinder from the volume of the rectangular solid.

Solution

$$V = LWH - \frac{1}{2}\left[\pi r^2 h\right]$$
$$\approx (12 \text{ in.} \cdot 84 \text{ in.} \cdot 3 \text{ in.}) - \frac{1}{2}(3.14)(2 \text{ in.})^2 (12 \text{ in.})$$
$$= 288 \text{ in}^3 - 75.36 \text{ in}^3$$
$$= 212.64 \text{ in}^3$$

The volume of the bushing is approximately 212.64 in^3.

41. **Strategy** To find the number of gallons in the aquarium:

• Use the formula for the volume of a rectangular solid.

• Convert the volume to gallons.

Solution $V = LWH$

$= 18 \text{ in} \cdot 12 \text{ in} \cdot 16 \text{ in}$

$= 3456 \text{ in}^3$

3456 in^3

$= 3456 \text{ in}^3 \times \dfrac{1 \text{ gal}}{231 \text{ in}^3}$

$\approx 15.0 \text{ gal}$

It will take 15.0 gal of water to fill the aquarium.

43. No

45. Yes

47. **Strategy** To find the cost of the floor:

• Find the volume. The volume is equal to the volume of a rectangular solid plus one half the volume of the cylinder. The radius is one half the length of the rectangular solid.

• Multiply the volume by \$10.

Solution $V = LWH + \dfrac{1}{2}\pi r^2 h$

$\approx 50 \text{ ft} \cdot 25 \text{ ft} \cdot \dfrac{1}{2} \text{ ft} + \dfrac{1}{2}(3.14)(25 \text{ ft})^2 \left(\dfrac{1}{2} \text{ ft}\right)$

$= 625 \text{ ft}^3 + 490.625 \text{ ft}^3$

$= 1115.625 \text{ ft}^3$

$\text{Cost} = 1115.625 \times 10 \approx 11{,}156.25$

The cost is approximately \$11,156.25.

Critical Thinking

49. For example, beginning at an edge that is perpendicular to the bottom face, cut at an angle through to the bottom face.

51. For example, beginning on the top face, at a distance d from a vertex, cut across the cube to a point just below the opposite vertex.

Section 12.5

Concept Check

1. 0, 1, 49, 64, 81, 100

Objective A Exercises

3. 2.646

5. 6.481

7. 12.845

9. 13.748

11. True

Objective B Exercises

13. $\text{Hypotenuse} = \sqrt{(\text{leg})^2 + (\text{leg})^2}$

$= \sqrt{(3 \text{ in.})^2 + (4 \text{ in.})^2}$

$= \sqrt{9 \text{ in}^2 + 16 \text{ in}^2}$

$= \sqrt{25 \text{ in}^2}$

$= 5 \text{ in.}$

15. $\text{Hypotenuse} = \sqrt{(\text{leg})^2 + (\text{leg})^2}$

$= \sqrt{(5 \text{ cm})^2 + (7 \text{ cm})^2}$

$= \sqrt{25 \text{ cm}^2 + 49 \text{ cm}^2}$

$= \sqrt{74 \text{ cm}^2}$

$\approx 8.602 \text{ cm}$

17. $\text{Leg} = \sqrt{(\text{hypotenuse})^2 - (\text{leg})^2}$

$= \sqrt{(15 \text{ ft})^2 - (10 \text{ ft})^2}$

$= \sqrt{225 \text{ ft}^2 - 100 \text{ ft}^2}$

$= \sqrt{125 \text{ ft}^2}$

$\approx 11.180 \text{ ft}$

19. $\text{Leg} = \sqrt{(\text{hypotenuse})^2 - (\text{leg})^2}$
$= \sqrt{(6\text{ cm})^2 - (4\text{ cm})^2}$
$= \sqrt{36\text{ cm}^2 - 16\text{ cm}^2}$
$= \sqrt{20\text{ cm}^2}$
$\approx 4.472\text{ cm}$

21. $\text{Hypotenuse} = \sqrt{(\text{leg})^2 + (leg)^2}$
$= \sqrt{(9\text{ yd})^2 + (9\text{ yd})^2}$
$= \sqrt{81\text{ yd}^2 + 81\text{ yd}^2}$
$= \sqrt{162\text{ yd}^2}$
$\approx 12.728\text{ yd}$

23. $\text{Leg} = \sqrt{(\text{hypotenuse})^2 - (\text{leg})^2}$
$= \sqrt{(12\text{ ft})^2 - (6\text{ ft})^2}$
$= \sqrt{144\text{ ft}^2 - 36\text{ ft}^2}$
$= \sqrt{144\text{ ft}^2}$
$\approx 10.392\text{ ft}$

25. $\text{Hypotenuse} = \sqrt{(\text{leg})^2 + (\text{leg})^2}$
$= \sqrt{(15\text{ cm})^2 + (15\text{ cm})^2}$
$= \sqrt{225\text{ cm}^2 + 225\text{ cm}^2}$
$= \sqrt{450\text{ cm}^2}$
$\approx 21.213\text{ cm}$

27. $\text{Hypotenuse} = \sqrt{(\text{leg})^2 + (\text{leg})^2}$
$= \sqrt{(8\text{ m})^2 + (4\text{ m})^2}$
$= \sqrt{64\text{ m}^2 + 16\text{ m}^2}$
$= \sqrt{80\text{ m}^2}$
$\approx 8.944\text{ m}$

29. $\text{Leg} = \sqrt{(\text{hypotenuse})^2 - (\text{leg})^2}$
$= \sqrt{(11.3\text{ yd})^2 - (8.1\text{ yd})^2}$
$= \sqrt{127.69\text{ yd}^2 - 65.16\text{ yd}^2}$
$= \sqrt{62.08\text{ yd}^2}$
$\approx 7.879\text{ yd}$

31. A right triangle with hypotenuse of length 50 units and a leg of length 40 units

Objective C Exercises

33. **Strategy** To find the distance between the holes, use the Pythagorean Theorem. The distance is the hypotenuse of a right triangle. The legs are 6 and 2 in.

Solution
$\text{Hypotenuse} = \sqrt{(\text{leg})^2 + (\text{leg})^2}$
$= \sqrt{(6\text{ in.})^2 + (2\text{ in.})^2}$
$= \sqrt{36\text{ in}^2 + 4\text{ in}^2}$
$= \sqrt{40\text{ in}^2}$
$\approx 6.32\text{ in.}$

The distance between the holes is 6.32 in.

35. **Strategy**
- Traveling 12 mi west and then 16 mi south forms a right angle. The distance from the starting point is the hypotenuse of the triangle with legs 12 mi and 16 mi.
- Find the hypotenuse of the right triangle.

Solution

$$\begin{aligned}\text{Hypotenuse} &= \sqrt{(\text{leg})^2 + (\text{leg})^2} \\ &= \sqrt{(12\text{ mi})^2 + (16\text{ mi})^2} \\ &= \sqrt{144\text{ mi}^2 + 256\text{ mi}^2} \\ &= \sqrt{400\text{ mi}^2} \\ &\approx 20\text{ mi}\end{aligned}$$

You are 20 mi from your starting point.

37. Strategy • The angles of a rectangle are right angles. The length (8 m) and width (3.5 m) are the legs of a right triangle. The diagonal is the hypotenuse.

• Find the length of the hypotenuse.

Solution

$$\begin{aligned}\text{Hypotenuse} &= \sqrt{(\text{leg})^2 + (\text{leg})^2} \\ &= \sqrt{(8\text{ m})^2 + (3.5\text{ m})^2} \\ &= \sqrt{64\text{ m}^2 + 12.25\text{ m}^2} \\ &= \sqrt{76.25\text{ m}^2} \\ &\approx 8.7\text{ m}\end{aligned}$$

The length of the diagonal is 8.7 m.

39. Strategy To find the distance between the holes, use the Pythagorean Theorem. The distance is the length of the hypotenuse of a right triangle. The legs are each 3 in.

Solution

$$\begin{aligned}\text{Hypotenuse} &= \sqrt{(\text{leg})^2 + (\text{leg})^2} \\ &= \sqrt{(3\text{ in.})^2 + (3\text{ in.})^2} \\ &= \sqrt{9\text{ in}^2 + 9\text{ in}^2} \\ &= \sqrt{18\text{ in}^2} \\ &\approx 4.243\text{ in}\end{aligned}$$

The distance is 4.243 in.

41. Only (i) is possible, because b cannot be greater than c.

43. Strategy To find the distance from the corner to the memorial, use the Pythagorean Theorem. The length of one leg is 600 ft. The length of the hypotenuse is 650 ft. The distance from the corner to the memorial is the length of the unknown side.

Solution

$$\begin{aligned}\text{Leg} &= \sqrt{(\text{hypotenuse})^2 - (\text{leg})^2} \\ &= \sqrt{(650\text{ ft})^2 - (600\text{ ft})^2} \\ &= \sqrt{422{,}500\text{ ft}^2 - 360{,}000\text{ ft}^2} \\ &= \sqrt{62{,}500\text{ ft}^2} \\ &\approx 250\text{ ft}\end{aligned}$$

The distance is 250 ft.

45. Strategy • Use the Pythagorean Theorem to find the length of the unknown side.

• Add the lengths of the sides to find the perimeter of the right triangle.

Solution

$$\begin{aligned}\text{Hypotenuse} &= \sqrt{(\text{leg})^2 + (\text{leg})^2} \\ &= \sqrt{(6\text{ in.})^2 + (10\text{ in.})^2} \\ &= \sqrt{36\text{ in}^2 + 100\text{ in}^2} \\ &= \sqrt{136\text{ in}^2} \\ &\approx 11.7\text{ in.}\end{aligned}$$

$6\text{ in.} + 10\text{ in.} + 11.7\text{ in.} = 27.7\text{ in.}$

The perimeter is 27.7 in.

47. Strategy To find the offset distance of the pipe:

• Find the length of the bent portion of the pipe by subtracting the straight portions of the pipe from the total length (62 in.).

• Use the Pythagorean

Theorem to find the offset distance. The length of the bent portion is the hypotenuse. One leg is 9 in. and the other leg is the offset distance.

Solution

$$62 \text{ in.} - \left(20\frac{3}{4} \text{ in.} + 31\frac{1}{2} \text{ in.}\right)$$

$$62 \text{ in.} - \left(20\frac{3}{4} \text{ in.} + 31\frac{2}{4} \text{ in.}\right)$$

$$62 \text{ in.} - \left(51\frac{5}{4}\text{in.}\right)$$

$$62 \text{ in.} - \left(52\frac{1}{4}\text{in.}\right)$$

$$61\frac{4}{4} \text{ in.} - \left(52\frac{1}{4}\text{in.}\right) = 9\frac{3}{4} \text{ in.}$$

$$\text{Leg} = \sqrt{\left(9\frac{3}{4} \text{ in.}\right)^2 - (9 \text{ in.})^2}$$

$$\text{The distance is } 3\frac{3}{4} \text{ in.}$$

Critical Thinking

49. No, the Pythagorean Theorem can be used only to find unknown lengths of sides of right triangles. No right angle is indicated in the triangle in the diagram.

Section 12.6

Concept Check

1. Yes, no

Objective A Exercises

3. $\dfrac{5 \cancel{\text{ m}}}{10 \cancel{\text{ m}}} = \dfrac{1}{2}$

5. $\dfrac{9 \cancel{\text{ in.}}}{12 \cancel{\text{ in.}}} = \dfrac{3}{4}$

7. $\angle CAB = \angle DEF$

$AC = ED$ and

$AB = EF$

Therefore SAS applies and the triangles are congruent.

9.
$$\frac{AC}{DF} = \frac{AB}{DE}$$
$$\frac{5 \cancel{\text{ cm}}}{9 \cancel{\text{ cm}}} = \frac{4 \text{ cm}}{DE}$$
$$5 \times DE = 4 \text{ cm} \times 9$$
$$5 \times DE = 36 \text{ cm}$$
$$DE = 36 \text{ cm} \div 5$$
$$DE = 7.2 \text{ cm}$$

11.
$$\frac{AC}{DF} = \frac{\text{height of triangle } ABC}{\text{height of triangle } DEF}$$
$$\frac{3 \cancel{\text{ m}}}{5 \cancel{\text{ m}}} = \frac{2 \text{ m}}{\text{height}}$$
$$3 \times \text{height} = 5 \times 2 \text{ m}$$
$$3 \times \text{height} = 10 \text{ m}$$
$$\text{Height} = 10 \text{ m} \div 3$$
$$\text{Height} \approx 3.3 \text{ m}$$

13. True

Objective B Exercises

15. **Strategy** To find the perimeter:

- Solve a proportion to find the length of side DF.
- Add the lengths of the three sides the triangle.

Solution

$$\frac{AB}{DE} = \frac{AC}{DF}$$
$$\frac{6 \cancel{\text{ cm}}}{12 \cancel{\text{ cm}}} = \frac{5 \text{ cm}}{DF}$$
$$6 \times DF = 12 \times 5 \text{ cm}$$
$$6 \times DF = 60 \text{ cm}$$
$$DF = 60 \text{ cm} \div 6$$
$$DF = 10 \text{ cm}$$
$$10 \text{ cm} + 12 \text{ cm} + 16 \text{ cm} = 38 \text{ cm}$$

The perimeter is 38 cm.

17. **Strategy** To find the area:

• Solve a proportion to find the length of side DE (the base of triangle DEF).

• Use the formula $A = \frac{1}{2}bh$.

Solution

$$\frac{AB}{DE} = \frac{\text{height of triangle } ABC}{\text{height of triangle } DEF}$$

$$\frac{8 \text{ m}}{DE} = \frac{4 \text{ m}}{7 \text{ m}}$$

$$DE \times 4 = 8 \text{ m} \times 7$$

$$DE \times 4 = 56 \text{ m}$$

$$DE = 56 \text{ m} \div 4$$

$$DE = 14 \text{ m}$$

$$A = \frac{1}{2}bh$$

$$= \frac{1}{2} \cdot 14 \text{ m} \cdot 7 \text{ m}$$

$$= 49 \text{ m}^2$$

The area is 49 m^2.

Critical Thinking

19. Yes. Given two squares, the ratios of corresponding sides are equal because the same number will be in the numerators (the length of a side of one square) and the same number will be in the denominators (the length of a side of the second square.).

No. The lengths of the sides of a rectangle vary. Therefore, given two rectangles, the ratios of corresponding sides may vary.

Projects or Group Activities

21. ΔPRE and ΔPOC are similar triangles.

$$\frac{PR}{50} = \frac{PR + 45}{75}$$

$$50(PR + 45) = 75PR$$

$$50PR + 2250 = 75PR$$

$$50PR - 50PR + 2250 = 75PR - 50PR$$

$$2250 = 25PR$$

$$\frac{2250}{25} = \frac{25PR}{25}$$

$$90 = PR$$

The distance is 90 m.

Chapter 12 Review Exercises

1. $r = \frac{1}{2}d = \frac{1}{2}(1.5 \text{ cm}) = 0.75 \text{ m}$

2. $C = 2\pi r$

$\approx 2(3.14)(5 \text{ cm}) = 31.4 \text{ cm}$

3. $P = 2L + 2W$

$= 2(8 \text{ ft}) + 2(5 \text{ ft})$

$= 16 \text{ ft} + 10 \text{ ft} = 26 \text{ ft}$

4. $AD = AB + BC + CD$

$24 = 15 + BC + 6$

$24 = 21 + BC$

$24 - 21 = 21 - 21 + BC$

$3 = BC$

5. Volume = length · width · height

$= 10 \text{ ft} \cdot 5 \text{ ft} \cdot 4 \text{ ft} = 200 \text{ ft}^3$

6. Hypotenuse $= \sqrt{(\text{leg})^2 + (\text{leg})^2}$

$= \sqrt{(10 \text{ cm})^2 + (24 \text{ cm})^2}$

$= \sqrt{100 \text{ cm}^2 + 576 \text{ cm}^2}$

$= \sqrt{676 \text{ cm}^2}$

$= 26 \text{ cm}$

7. Let x represent the supplement of 105°. The sum of supplementary angles is 180°.

$$x + 105° = 180°$$
$$x + 105° - 105° = 180° - 105°$$
$$x = 75°$$

75° is the supplement of 105°.

8. $\sqrt{15} \approx 3.873$

9. $$\frac{BC}{EF} = \frac{\text{height of triangle } ABC}{\text{height of triangle } DEF}$$
$$\frac{12 \text{ cm}}{24 \text{ cm}} = \frac{8 \text{ cm}}{h}$$
$$12 \times h = 24 \times 8 \text{ cm}$$
$$12 \times h = 192 \text{ cm}$$
$$h = 192 \text{ cm} \div 12 = 16 \text{ cm}$$

10. $A = \pi r^2$
$$\approx 3.14 \cdot (4.5 \text{ cm})^2$$
$$= 63.585 \text{ cm}^2$$

11a. Because line t is a transversal cutting parallel lines, $\angle b = 45°$

b. $\angle a = 180° - 45° = 135°$

12. $A = LW$
$$= 11 \text{ m} \times 5 \text{ m} = 55 \text{ m}^2$$

13.

Volume = volume of larger rectangular solid
− volume of smaller rectangular solid
= length · width · height
− length · width · height
$$= 8 \text{ in.} \cdot 7 \text{ in.} \cdot 6 \text{ in.} - 8 \text{ in.} - 4 \text{ in.} \cdot 3 \text{ in.}$$
$$= 336 \text{ in}^3 - 96 \text{ in}^3 = 240 \text{ in}^3$$

14. Area = area of rectangle $+ \frac{1}{2}$ (area of circle)
$$= \text{length} \cdot \text{width} + \frac{1}{2}\pi (\text{radius})^2$$
$$\approx 8 \text{ in.} \cdot 4 \text{ in.} + \frac{1}{2}(3.14)(4 \text{ in.})^2$$
$$= 32 \text{ in}^2 + 25.12 \text{ in}^2$$
$$= 57.12 \text{ in}^2$$

15. $V = \frac{4}{3}\pi r^3$
$$\approx \frac{4}{3}(3.14)(4 \text{ ft})^3$$
$$\approx 267.9 \text{ ft}^3$$

16. **Strategy** To find the area:
• Solve a proportion to find the length of side DF (the base of the triangle DEF).
• Use the formula $A = \frac{1}{2}bh$.

Solution

$$\frac{AC}{DF} = \frac{\text{height of triangle } ABC}{\text{height of triangle } DEF}$$
$$\frac{8 \text{ m}}{DF} = \frac{5 \text{ m}}{9 \text{ m}}$$
$$8 \text{ m} \times 9 = 5 \times DF$$
$$72 \text{ m} = 5 \times DF$$
$$72 \text{ m} \div 5 = DF$$
$$14.4 \text{ m} = DF$$
$$A = \frac{1}{2}bh$$
$$= \frac{1}{2}(14.4 \text{ m})(9 \text{ m}) = 64.8 \text{ m}^2$$

The area is 64.8 m^2.

17. Perimeter = length of two sides
$+ \frac{1}{2}$ circumference of circle
$$\approx 2(16 \text{ in.}) + \frac{1}{2}(2 \cdot 3.14 \cdot 5 \text{ in.})$$
$$= 32 \text{ in.} + 15.7 \text{ in.} = 47.7 \text{ in.}$$

18a. Because line t is a transversal cutting parallel lines, $\angle b = 80°$

b. $\angle a = 180° - 80° = 100°$

19. **Strategy** To find how high on the building the ladder will reach, use the Pythagorean Theorem. The hypotenuse is 17 ft and one leg is 8 ft. The other leg is the height up the building.

Solution

$$\text{leg} = \sqrt{(\text{hypotenuse})^2 - (\text{leg})^2}$$
$$= \sqrt{(17\text{ ft})^2 - (8\text{ ft})^2}$$
$$= \sqrt{289\text{ ft}^2 - 64\text{ ft}^2}$$
$$= \sqrt{225\text{ ft}^2}$$
$$= 15\text{ ft}$$

The ladder will reach 15 ft up the building.

20. $90° - 32° = 58°$

The other angles of the triangle are 90° and 58°.

21. **Strategy** To find how many feet the bicycle travels, find how many feet the wheel travels if it makes 10 revolutions:

- Find how far the wheel travels when it makes 1 revolution by using the circumference formula.
- Convert the circumference to feet.
- Multiply the distance traveled in 1 revolution by 10.

Solution

$$C = \pi d$$
$$= \pi \cdot 28\text{ in.}$$
$$\approx 3.14 \cdot (28\text{ in.})$$
$$= 87.92\text{ in.}$$

$$87.92\text{ in.} = 87.92\ \cancel{\text{in.}} \times \frac{1\text{ ft}}{12\ \cancel{\text{in.}}}$$
$$= \frac{87.92}{12}\text{ ft} \approx 7.33\text{ ft}$$
$$10 \times 7.33\text{ ft} = 73.3\text{ ft}$$

The bicycle travels approximately 73.3 ft in 10 revolutions.

22a. **Strategy** To find the area of the glass:

- Use the area of the rectangle formula.
- Multiply the result by 2.

Solution

$$A = LW$$
$$= 40\text{ ft} \cdot 20\text{ ft} = 800\text{ ft}^2$$
$$800\text{ ft}^2 \times 2 = 1600\text{ ft}^2$$

The area of the glass inside and out is 1600 ft^2.

b. **Strategy** To find the volume, use the formula for the volume of a rectangular solid.

Solution

$$V = LWH$$
$$= 40\text{ ft} \cdot 20\text{ ft} \cdot 12.5\text{ in.}$$
$$= (40 \times 12)\text{in.} \cdot (20 \times 12)\text{in.} \cdot 12.5\text{ in.}$$
$$= (480\text{ in.}) \cdot (240\text{ in.}) \cdot (12.5\text{ in.})$$
$$= 1{,}440{,}000\text{ in}^3$$

The volume of the pane of glass is 1,440,000 in^3.

23. **Strategy** To find the volume of the silo, use the formula for the volume of a cylinder.

Solution $V = \pi r^2 h$

$\approx 3.14\,(4.5 \text{ ft})^2\,(18 \text{ ft})$

$= 1144.53 \text{ ft}^3$

The volume of the silo is approximately 1144.53 ft^3.

24. $A = \frac{1}{2}bh$

$= \frac{1}{2}(8 \text{ m})(2.75 \text{ m})$

$= 11 \text{ m}^2$

25. Strategy • Traveling 20 mi west and then 21 mi south forms a right angle. The distance from the starting point is the hypotenuse of the triangle with legs 20 mi and 21 mi.

• Find the hypotenuse of the right triangle.

Solution

$\text{hypotenuse} = \sqrt{(\text{leg})^2 + (\text{leg})^2}$

$= \sqrt{(20 \text{ mi})^2 + (21 \text{ mi})^2}$

$= \sqrt{400 \text{ mi}^2 + 441 \text{ mi}^2}$

$= \sqrt{841 \text{ mi}^2}$

$= 29 \text{ mi}$

The distance from the starting point is 29 mi.

Chapter 12 Test

1. $V = \pi r^2 h$

$\approx 3.14 \cdot (3 \text{ m})^2 \cdot 6 \text{ m}$

$= 169.56 \text{ m}^3$

2. $P = 2L + 2W$

$= 2(2 \text{ m}) + 2(1.4 \text{ m})$

$= 4 \text{ m} + 2.8 \text{ m}$

$= 6.8 \text{ m}$

3. Strategy To find the volume of the composite figure, subtract the volume of the smaller cylinder from the volume of the larger cylinder.

Solution Volume

= volume of larger cylinder − volume of smaller cylinder

$= \pi(\text{radius})^2 \cdot \text{height} - \pi \cdot (\text{radius})^2 \cdot \text{height}$

$\approx 3.14\,(6 \text{ cm})^2 \cdot 14 \text{ cm} - 3.14 \cdot (2 \text{ cm})^2 \cdot 14 \text{ cm}$

$= 1582.56 \text{ cm}^3 - 175.84 \text{ cm}^3$

$= 1406.72 \text{ cm}^3$

The volume of the composite figure is approximately 1406.72 cm^3.

4. Strategy To find the missing length, use the Pythagorean Theorem.

$AB = FE$ is the hypotenuse.

The legs are 6 and 8 m.

Solution $\text{Hypotenuse} = \sqrt{(8 \text{ m})^2 + (6 \text{ m})^2}$

$= \sqrt{64 \text{ m}^2 + 36 \text{ m}^2}$

$= \sqrt{100 \text{ m}^2}$

$= 10 \text{ m}$

The length of FE is 10 m.

5. $90° - 32° = 58°$

58° is the complement of 32°.

6. $A = \pi r^2$

$\approx \frac{22}{7}(1 \text{ m})^2$

$= \frac{22 \text{ m}^2}{7} = 3\frac{1}{7} \text{ m}^2$

7. Angles x and z are supplementary; therefore,

$\angle z = 180° - 30° = 150°$. $\angle y$ and $\angle z$ are

corresponding angles; therefore,

$\angle y = \angle z = 150°$.

8.

$$\begin{aligned}\text{Perimeter} &= \text{two lengths} + \text{circumference of circle}\\ &= 2(4\text{ ft}) + \pi \cdot \text{diameter}\\ &= 8\text{ ft} + \pi\left(2\frac{1}{2}\text{ ft}\right)\\ &\approx 8\text{ ft} + 3.14(2.5\text{ ft})\\ &= 15.85\text{ ft}\end{aligned}$$

9. $\sqrt{189} \approx 13.748$

10.
$$\begin{aligned}\text{Leg} &= \sqrt{(\text{hypotenuse})^2 - (\text{leg})^2}\\ &= \sqrt{(12\text{ ft})^2 - (7\text{ ft})^2} = \sqrt{144\text{ ft}^2 - 49\text{ ft}^2}\\ &= \sqrt{95\text{ ft}^2}\\ &= 9.747\text{ ft}\end{aligned}$$

11. Area = area of rectangle − area of triangle

$$\begin{aligned}&= \text{length} \cdot \text{width} - \frac{1}{2} \cdot \text{base} \cdot \text{height}\\ &= 3\text{ ft} \cdot 4\frac{1}{2}\text{ ft} - \frac{1}{2}\left(4\frac{1}{2}\text{ ft}\right)\left(1\frac{1}{2}\text{ ft}\right)\\ &= \left(\frac{3}{1}\cdot\frac{9}{2}\right)\text{ft}^2 - \left(\frac{1}{2}\cdot\frac{9}{2}\cdot\frac{3}{2}\right)\text{ft}^2\\ &= \frac{27}{2}\text{ ft}^2 - \frac{27}{8}\text{ ft}^2\\ &= \frac{108}{8}\text{ft}^2 - \frac{27}{8}\text{ft}^2\\ &= \frac{81}{8}\text{ ft}^2 = 10\frac{1}{8}\text{ft}^2\end{aligned}$$

12. Angles x and b are supplementary angles.

$$\begin{aligned}\angle x + \angle b &= 180°\\ 45° + \angle b &= 180°\\ 45° - 45° + \angle b &= 180° - 45°\\ \angle b &= 135°\end{aligned}$$

$\angle a = \angle x$ because $\angle a$ and $\angle x$ are alternate exterior angles. $\angle a = 45°$

13. $\dfrac{AB}{DE} = \dfrac{BC}{EF}$

$$\frac{\frac{3}{4}\text{ ft}}{2\frac{1}{2}\text{ ft}} = \frac{BC}{4\text{ ft}}$$

$$\frac{3}{4} \times 4\text{ ft} = 2\frac{1}{2} \times BC$$

$$3\text{ ft} = 2\frac{1}{2} \times BC$$

$$3\text{ ft} \div 2\frac{1}{2} = BC$$

$$3\text{ ft} \times \frac{2}{5} = BC$$

$$BC = \frac{6}{5}\text{ ft} = 1\frac{1}{5}\text{ ft}$$

14. $90° - 40° = 50°$

The other two angles of the triangle are 90° and 50°.

15. **Strategy** To find the width of the canal, solve a proportion.

Solution

$$\frac{5\text{ ft}}{\text{Width of canal}} = \frac{12\ \cancel{\text{ft}}}{60\ \cancel{\text{ft}}}$$

$$\begin{aligned}5\text{ ft} \times 60 &= 12 \times \text{width of canal}\\ 300\text{ ft} &= 12 \times \text{width of canal}\\ 300\text{ ft} \div 12 &= \text{width of canal}\\ 25\text{ ft} &= \text{width of canal}\end{aligned}$$

The width of the canal is 25 ft.

16. **Strategy** To find how much more pizza is contained in the larger pizza, subtract the area of the smaller pizza from the area of the larger pizza.

Solution

$$A = \pi r^2$$
$$\approx 3.14 \cdot (10 \text{ in.})^2$$
$$= 314 \text{ in}^2$$
$$A = \pi r^2$$
$$\approx 3.14 \cdot (8 \text{ in.})^2$$
$$= 200.96 \text{ in}^2$$
$$314 \text{ in}^2 - 200.96 \text{ in}^2$$
$$= 113.04 \text{ in}^2$$

The amount of extra pizza is 113.04 in^2.

17. **Strategy** To find the cost of the carpet:

• Subtract the area of the smaller rectangle from the area of the larger rectangle.

• Convert the area to square yards.

• Multiply the area in square yards by the cost per square yard.

Solution

Area = area of larger rectangle − area of smaller rectangle
$$= \text{length} \cdot \text{width} - \text{length} \cdot \text{width}$$
$$= 20 \text{ ft} \cdot 22 \text{ ft} - 6 \text{ ft} \cdot 11 \text{ ft}$$
$$= 440 \text{ ft}^2 - 66 \text{ ft}^2 = 374 \text{ ft}^2$$
$$374 \text{ ft}^2 = 374 \text{ } \cancel{\text{ft}}^2 \times \frac{1 \text{ yd}^2}{9 \text{ } \cancel{\text{ft}}^2}$$
$$\approx 41.5556 \text{ yd}^2$$
$$41.5556 \text{ yd}^2 \times \$26.80 \approx \$1113.69$$

It will cost \$1113.69 to carpet the area.

18. **Strategy** To find the length of the rafter:

• Use the Pythagorean Theorem to find the part of the rafter that covers the roof.

• Find the total length of the rafter by adding the 2 ft overhang to the part that covers the roof.

Solution

$$\text{Hypotenuse} = \sqrt{(5 \text{ ft})^2 + (12 \text{ ft})^2}$$
$$= \sqrt{25 \text{ ft}^2 + 144 \text{ ft}^2}$$
$$= \sqrt{169 \text{ ft}^2} = 13 \text{ ft}$$
$$13 \text{ ft} + 2 \text{ ft} = 15 \text{ ft}$$

The length of the rafter is 15 ft.

19. **Strategy** To find the cross-sectional area of the redwood tree:

• Convert the diameter (11 ft 6 in.) to feet.

• Use the formula $r = \frac{1}{2}d$ to find radius.

• Use the formula for area of a circle.

Solution

$$6 \text{ in.} = 6 \text{ } \cancel{\text{in.}} \times \frac{1 \text{ ft}}{12 \text{ } \cancel{\text{in.}}} = 0.5 \text{ ft}$$
$$11 \text{ ft } 6 \text{ in.} = 11.5 \text{ ft}$$
$$r = \frac{1}{2}d = \frac{1}{2}(11.5 \text{ ft}) = 5.75 \text{ ft}$$
$$A = \pi r^2$$
$$\approx (3.14)(5.75 \text{ ft})^2$$
$$\approx 103.82 \text{ ft}^2$$

The cross-sectional area is approximately 103.82 ft^2.

20a. Strategy To find the area of the floor of a cell, use the formula for the area of a rectangle.

Solution $A = LW$

$= (9\text{ ft})(5\text{ ft})$

$= 45\text{ ft}^2$

The area of the floor is 45 ft^2.

b. Strategy To find the volume of a cell, use the formula for the volume of a rectangular solid.

Solution $V = LWH$

$= (9\text{ ft})(5\text{ ft})(7\text{ ft})$

$= 315\text{ ft}^3$

The volume of the cell is 315 ft^3.

Cumulative Review Exercises

1.

	2	3
96 =	2 · 2 · 2 · 2 · 2	3
144 =	2 · 2 · 2 · 2	3 · 3

GCF = 2 · 2 · 2 · 2 · 3 = 48

2. $3\frac{5}{12} = 3\frac{20}{48}$

$2\frac{9}{16} = 2\frac{27}{48}$

$+1\frac{7}{8} = 1\frac{42}{48}$

$6\frac{89}{48} = 7\frac{41}{48}$

3. $4\frac{1}{3} \div 6\frac{2}{9} = \frac{13}{3} \div \frac{56}{9} = \frac{13}{3} \times \frac{9}{56}$

$= \frac{13 \cdot \overset{1}{\cancel{3}} \cdot 3}{\underset{1}{\cancel{3}} \cdot 7 \cdot 2 \cdot 2 \cdot 2} = \frac{39}{56}$

4. $\left(\frac{2}{3}\right)^2 \div \left(\frac{1}{3} + \frac{1}{2}\right) - \frac{2}{5}$

$= \left(\frac{2}{3} \cdot \frac{2}{3}\right) \div \left(\frac{2}{6} + \frac{3}{6}\right) - \frac{2}{5}$

$= \frac{4}{9} \div \frac{5}{6} - \frac{2}{5}$

$= \frac{4}{9} \times \frac{6}{5} - \frac{2}{5}$

$= \frac{2 \cdot 2 \cdot 2 \cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \cdot 3 \cdot 5} - \frac{2}{5}$

$= \frac{8}{15} - \frac{2}{5}$

$= \frac{8}{15} - \frac{6}{15} = \frac{2}{15}$

5. $-\frac{2}{3} - \left(-\frac{5}{8}\right) = -\frac{16}{24} + \frac{15}{24} = -\frac{1}{24}$

6. $\frac{\$348.80}{20\text{ h}} = \$17.44/\text{h}$

7. $\frac{3}{8} = \frac{n}{100}$

$3 \times 100 = n \times 8$

$300 = n \times 8$

$300 \div 8 = n$

$37.5 = n$

8. $37\frac{1}{2}\% = \frac{75}{2}\% = \frac{75}{2} \times \frac{1}{100}$

$= \frac{75}{200} = \frac{3}{8}$

9. $2^2 - \left[(-2)^2 - (-4)\right] = 4 - [4 + 4]$

$= 4 - 8 = -4$

10. $36.4\% \times n = 30.94$

$0.364 \times n = 30.94$

$n = 30.94 \div 0.364$

$n = 85$

11. $\frac{x}{3}+3=1$

$\frac{x}{3}=-2$

$x=-6$

The solution is -6.

12. $2(x-3)+2=5x-8$

$2x-6+2=5x-8$

$2x-4=5x-8$

$4=3x$

$\frac{4}{3}=x$

The solution is $\frac{4}{3}$.

13. 32.5 km = 32,500 m

14.
$$\begin{array}{r} 32\text{ m} = 32.00\text{ m} \\ -42\text{ cm} = \underline{\ 0.42\text{ m}} \\ 31.58\text{ m} \end{array}$$

15. $\frac{2}{3}x=-10$

$x=\frac{3}{2}(-10)$

$x=-15$

The solution is -15.

16. $2x-4(x-3)=8$

$2x-4x+12=8$

$-2x+12=8$

$-2x=-4$

$x=2$

The solution is 2.

17. **Strategy** To find the monthly payment:

- Find the amount paid in payments by the subtracting the down payment ($1000) from the price ($26,488).
- Divide the amount paid in payments by the number of payments (36).

Solution $26,488-1000=25,488$

$$36\overline{)25,488}\quad 708$$

The monthly payment is $708.

18. **Strategy** To find the sales tax, solve a proportion.

Solution $\frac{\$175}{\$6.75}=\frac{\$1220}{n}$

$175\times n=6.75\times 1220$

$175\times n=8235$

$n=8235\div 175\approx 47.06$

The sales tax on the home theater system is $47.06.

19. **Strategy** To find the operator's original wage, solve the basic percent equation for the base. The percent is 110% and the amount is $32.12.

Solution $110\%\times n=32.12$

$1.10\times n=32.12$

$n=32.12\div 1.10=29.20$

The original wage was $29.20.

20. **Strategy** To find the sale price:

- Find the amount of the markdown by solving the basic percent equation for amount. The base is $240 and the percent is 55%.
- Subtract the amount of the markdown from the original price ($240).

Solution $55\%\times 240=n$ $\qquad$ $0.55\times 240=132$

$$\begin{array}{r} 240 \\ \underline{-132} \\ 108 \end{array}$$

The sale price of the PDA is \$108.

21. Strategy To find the value of the investment, multiply the amount invested by the compound interest factor.

Solution $\$25{,}000 \times 4.05466 = 101{,}366.50$

The value of the investment after 20 years would be \$101,366.50.

22. Strategy To find the weight of the package:

- Find the weight of the package in ounces by multiplying the weight of one tile (6 oz) by the number of tiles in the package (144).
- Convert the weight in ounces to pounds.

Solution $6 \text{ oz} \times 144 = 864 \text{ oz}$

$$864 \text{ oz} = 864 \text{ } \cancel{\text{oz}} \times \frac{1 \text{ lb}}{16 \text{ } \cancel{\text{oz}}} = 54 \text{ lb}$$

The weight of the package is 54 lb.

23. Strategy To find the distance between the rivets:

- Divide the length of the plates (5.4 m) by the number of spaces (9).
- Convert the meters to centimeters.

Solution

$$9\overline{)5.400}\quad 0.6$$

$0.6 \text{ m} = 60 \text{ cm}$

The distance between the rivets is 60 cm.

24. Let x = the number.

$$2 + 4x = -6$$
$$4x = -8$$
$$x = 2$$

The number is -2.

25a. Because vertical angles have the same measure, $\angle a = 74°$.

b. $\angle a$ and $\angle b$ are supplementary; therefore, $\angle b = 180° - \angle a = 180° - 74° = 106°$.

26.

$$\begin{aligned}\text{Perimeter} &= 2 \cdot \text{length} + \text{width} + \frac{1}{2}(\text{circumference}) \\ &\approx 2 \cdot (7 \text{ cm}) + 6 \text{ cm} + \frac{1}{2}(3.14 \cdot 6 \text{ cm}) \\ &= 14 \text{ cm} + 6 \text{ cm} + 9.42 \text{ cm} \\ &= 29.42 \text{ cm}\end{aligned}$$

27. Area = area of rectangle + area of triangle

$$\begin{aligned}&= \text{length} \cdot \text{width} + \frac{1}{2} \cdot \text{base} \cdot \text{height} \\ &= 5 \text{ in.} \cdot 4 \text{ in.} + \frac{1}{2} \cdot 12 \text{ in.} \cdot 5 \text{ in.} \\ &= 20 \text{ in}^2 + 30 \text{ in}^2 = 50 \text{ in}^2\end{aligned}$$

28. Volume = volume of rectangular solid $- \frac{1}{2}$ volume of cylinder

$$\begin{aligned}&= \text{length} \cdot \text{width} \cdot \text{height} - \frac{1}{2}\left[\pi (\text{radius})^2 \cdot \text{height}\right] \\ &\approx 8 \text{ in.} \cdot 4 \text{ in.} \cdot 3 \text{ in.} - \frac{1}{2}\left[3.14(0.5 \text{ in.})^2 \cdot 8 \text{ in.}\right] \\ &= 96 \text{ in}^3 - 3.14 \text{ in}^3 = 92.86 \text{ in}^3\end{aligned}$$

29.

$$\begin{aligned}\text{Hypotenuse} &= \sqrt{(\text{leg})^2 + (\text{leg})^2} \\ &= \sqrt{(8 \text{ ft})^2 + (7 \text{ ft})^2} \\ &= \sqrt{64 \text{ ft}^2 + 49 \text{ ft}^2} \\ &= \sqrt{113 \text{ ft}^2} \approx 10.63 \text{ ft}\end{aligned}$$

30. Strategy To find the perimeter of *DEF*:

- Solve a proportion to find the length of side *DF*.
- Solve a proportion to find the length of side *FE*.
- Use the formula for perimeter to find the perimeter of triangle *DEF*.

Solution

$$\frac{CB}{DE} = \frac{CA}{DF}$$

$$\frac{4 \text{ } \cancel{\text{cm}}}{12 \text{ } \cancel{\text{cm}}} = \frac{3 \text{ cm}}{DF}$$

$$4 \times DF = 3 \text{ cm} \times 12$$

$$4 \times DF = 36 \text{ cm}$$

$$DF = 36 \text{ cm} \div 4 = 9 \text{ cm}$$

$$\frac{CB}{DE} = \frac{AB}{FE}$$

$$\frac{4 \text{ } \cancel{\text{cm}}}{12 \text{ } \cancel{\text{cm}}} = \frac{5 \text{ cm}}{FE}$$

$$4 \times FE = 5 \text{ cm} \times 12$$

$$4 \times FE = 60 \text{ cm}$$

$$FE = 60 \text{ cm} \div 4 = 15 \text{ cm}$$

$$P = a + b + c$$

$$= 12 \text{ cm} + 15 \text{ cm} + 9 \text{ cm}$$

$$= 36 \text{ cm}$$

The perimeter is 36 cm.

Final Exam

1.
$$\begin{array}{r} {\scriptstyle 9}\quad {\scriptstyle 10} \\ 100,914 \\ -\,97,655 \\ \hline 3\,259 \end{array}$$

2.
$$\begin{array}{r} 53 \\ 657\overline{)34,821} \\ -3285 \\ \hline 1971 \\ -1971 \\ \hline 0 \end{array}$$

3.
$$\begin{array}{r} {\scriptstyle 9}\quad {\scriptstyle 9}\quad {\scriptstyle 9} \\ 90,001 \\ 27,796 \\ \hline 60,205 \end{array}$$

4. $3^2 \cdot (5-3)^2 \div 3 + 4 = 3^2 \cdot (2)^2 \div 3 + 4$
$= 9 \cdot 4 \div 3 + 4$
$= 36 \div 3 + 4$
$= 12 + 4$
$= 16$

5.

	2	3
$9 =$		$3 \cdot 3$
$12 =$	$2 \cdot 2$	3
$16 =$	$2 \cdot 2 \cdot 2 \cdot 2$	

$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 144$

6. $\frac{3}{8} + \frac{5}{6} + \frac{1}{5} = \frac{45}{120} + \frac{100}{120} + \frac{24}{120} = \frac{169}{120} = 1\frac{49}{120}$

7.
$$\begin{array}{r} 7\frac{5}{12} = 7\frac{20}{48} = 6\frac{68}{48} \\ -3\frac{13}{16} = 3\frac{39}{48} = 3\frac{39}{48} \\ \hline 3\frac{29}{48} \end{array}$$

8. $3\frac{5}{8} \times 1\frac{5}{7} = \frac{29}{8} \times \frac{12}{7} = \frac{29 \cdot \overset{3}{\cancel{12}}}{\underset{2}{\cancel{8}} \cdot 7} = \frac{87}{14} = 6\frac{3}{14}$

9. $1\frac{2}{3} \div 3\frac{3}{4} = \frac{5}{3} \div \frac{15}{4}$
$= \frac{5}{3} \times \frac{4}{15}$
$= \frac{5 \times 4}{3 \times 15}$
$= \frac{20}{45} = \frac{4}{9}$

10. $\left(\frac{2}{3}\right)^3 \left(\frac{3}{4}\right)^2 = \left(\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3}\right)\left(\frac{3}{4} \cdot \frac{3}{4}\right)$
$= \left(\frac{8}{27}\right)\left(\frac{9}{16}\right)$
$= \frac{72}{432} = \frac{1}{6}$

11. $\left(\frac{2}{3}\right)^2 \div \left(\frac{3}{4} + \frac{1}{3}\right) - \frac{1}{3}$
$= \left(\frac{2}{3}\right)^2 \div \left(\frac{9}{12} + \frac{4}{12}\right) - \frac{1}{3}$
$= \frac{4}{9} \div \frac{13}{12} - \frac{1}{3}$
$= \frac{4}{\underset{3}{\cancel{9}}} \times \frac{\overset{4}{\cancel{12}}}{13} - \frac{1}{3}$
$= \frac{16}{39} - \frac{1}{3}$
$= \frac{16}{39} - \frac{13}{39} = \frac{3}{39} = \frac{1}{13}$

12.
$$\begin{array}{r} {\scriptstyle 2}\,{\scriptstyle 3}\,{\scriptstyle 1} \\ 4.972 \\ 28.6 \\ 1.88 \\ +\,128.725 \\ \hline 164.177 \end{array}$$

13.
$$\begin{array}{r} 2.97 \\ \times\ 0.0094 \\ \hline 1188 \\ 2673 \\ \hline 0.027918 \end{array}$$

14.
$$\begin{array}{r} 0.687 \approx 0.69 \\ 0.062\overline{)0.042.600} \\ -372 \\ 540 \\ -496 \\ 440 \\ -434 \\ 6 \end{array}$$

15. $0.45 = \dfrac{45}{100} = \dfrac{9}{20}$

16. $\dfrac{323.4 \text{ mi}}{13.2 \text{ gal}} = 24.5 \text{ mi/gal}$

17.
$$\frac{12}{35} = \frac{n}{160}$$
$$12 \times 160 = n \times 35$$
$$1920 = n \times 35$$
$$1920 \div 35 = n$$
$$54.9 \approx n$$

18. $22\dfrac{1}{2}\% = \dfrac{45}{2} \times \dfrac{1}{100} = \dfrac{45}{200} = \dfrac{9}{40}$

19. $1.35 = 1.35 \times 100\% = 135\%$

20. $\dfrac{5}{4} = \dfrac{5}{4} \times 100\% = \dfrac{500}{4}\% = 125\%$

21. Percent × base = amount
$$120\% \times 30 = n$$
$$1.2 \times 30 = n$$
$$36 = n$$

22. Percent × base = amount
$$n \times 9 = 12$$
$$n = 12 \div 9 = 1\frac{1}{3} = 133\frac{1}{3}\%$$

23. Percent × base = amount
$$60\% \times n = 42$$
$$0.60 \times n = 42$$
$$n = 42 \div 0.60 = 70$$

24. $1\dfrac{2}{3} \text{ ft} = \dfrac{5}{3} \text{ ft} = \dfrac{5}{3} \text{ ft} \times \dfrac{12 \text{ in.}}{1 \text{ ft}} = 20 \text{ in.}$

25.
$$\begin{array}{r} 3 \text{ ft } 2 \text{ in.} = 2 \text{ ft } 14 \text{ in.} \\ -1 \text{ ft } 10 \text{ in.} = 1 \text{ ft } 10 \text{ in.} \\ \hline 1 \text{ ft } 4 \text{ in.} \end{array}$$

26. $40 \text{ oz} = 40 \text{ oz} \times \dfrac{1 \text{ lb}}{16 \text{ oz}} = \dfrac{40}{16} \text{ lb} = 2.5 \text{ lb}$

27.
$$\begin{array}{r} 3 \text{ lb } 12 \text{ oz} \\ +\ 2 \text{ lb } 10 \text{ oz} \\ \hline 5 \text{ lb } 22 \text{ oz} = 6 \text{ lb } 6 \text{ oz} \end{array}$$

28. $18 \text{ pt} = 18 \text{ pt} \times \dfrac{1 \text{ qt}}{2 \text{ pt}} \times \dfrac{1 \text{ gal}}{4 \text{ qt}}$
$$= \frac{18 \text{ gal}}{8} = 2.25 \text{ gal}$$

29.
$$\begin{array}{r} 1 \text{ gal } 3 \text{ qt} \\ 3\overline{)5 \text{ gal } 1 \text{ qt}} \\ -3 \text{ gal} \\ \hline 2 \text{ gal} = 8 \text{ qt} \\ 9 \text{ qt} \\ -9 \text{ qt} \\ \hline 0 \end{array}$$

30. 2.48 m = 248 cm

31. 4 m 62 cm = 4 m+ 0.62 m = 4.62 m

32. 1 kg 614 g =1 kg + 0.614 kg = 1.614 kg

33. 2 L 67 ml = 2000 ml + 67 ml = 2067 ml

34. $55 \text{ mi} \approx 55 \text{ mi} \times \dfrac{1.61 \text{ km}}{1 \text{ mi}} \approx 88.55 \text{ km}$

35. **Strategy** To find the cost:

• Find the number of watt-hours by multiplying the number of watts (2,400) by the number of hours (6).

• Convert watt-hours to kilowatt-hours.

• Multiply the kilowatt-hours by \$.08.

Solution

$$2,400 \text{ W} \times 6 \text{ h} = 14,400 \text{ Wh}$$
$$14,400 \text{ Wh} = 14.4 \text{ kWh}$$
$$14.43 \times 0.08 = 1.152$$

The cost is \$1.15.

36. The number is less than 10. Move the decimal point 8 places to the right. The exponent on 10 is –8.

$0.0000000679 = 6.79 \times 10^{-8}$

37. $P = 2L + 2W$

$= 2(1.2 \text{ m}) + 2(0.75 \text{ m})$

$= 2.4 \text{ m} + 1.5 \text{ m} = 3.9 \text{ m}$

38. $A = LW$

$= 9 \text{ in.} \times 5 \text{ in.} = 45 \text{ in}^2$

39. $V = LWH$

$= 20 \text{ cm} \times 12 \text{ cm} \times 5 \text{ cm}$

$= 1200 \text{ cm}^3$

40. $-2 + 8 + (-10) = 6 + (-10) = -4$

41. $-30 - (-15) = -30 + 15 = -15$

42. $2\frac{1}{2} \times -\frac{1}{5} = \frac{5}{2} \times \frac{-1}{5} = -\frac{1}{2}$

43. $-1\frac{3}{8} \div 5\frac{1}{2} = \frac{-11}{8} \div \frac{11}{2}$

$= \frac{-11}{8} \times \frac{2}{11}$

$= \frac{-1}{4} = -\frac{1}{4}$

44. $(-4)^2 \div (1-3)^2 - (-2)$

$= (-4)^2 \div (-2)^2 - (-2)$

$= 16 \div 4 - (-2)$

$= 4 - (-2)$

$= 4 + 2$

$= 6$

45. $2x - 3(x-4) + 5$

$= 2x + (-3)[x + (-4)] + 5$

$= 2x + (-3)x + (-3)(-4) + 5$

$= 2x + (-3)x + 12 + 5$

$= -x + 12 + 5$

$= -x + 17$

46. $\frac{2}{3}x = -12$

$\frac{3}{2} \cdot \frac{2}{3}x = \frac{3}{2} \cdot (-12)$

$x = -18$

The solution is -18.

47. $3x - 5 = 10$

$3x - 5 + 5 = 10 + 5$

$3x = 15$

$\frac{3x}{3} = \frac{15}{3}$

$x = 5$

The solution is 5.

48. $8 - 3x = x + 4$

$8 - 3x - x = x - x + 4$

$8 - 4x = 4$

$8 - 8 - 4x = 4 - 8$

$-4x = -4$

$\frac{-4x}{-4} = \frac{-4}{-4}$

$x = 1$

The solution is 1.

49. **Strategy** To find your new balance, subtract the check amounts ($321.88 and $34.23) and add the amount of the deposit ($443.56).

Solution

$$\begin{array}{r} 872.48 \\ -321.88 \\ \hline 550.60 \\ -\ 34.23 \\ \hline 516.37 \\ +443.56 \\ \hline 959.93 \end{array}$$

Your new balance is $959.93.

50. **Strategy** To find how many people will vote, solve a proportion.

Solution

$$\frac{5}{8} = \frac{n}{102,000}$$
$$5 \times 102,000 = 8 \times n$$
$$510,000 = 8 \times n$$
$$510,000 \div 8 = n$$
$$63,750 = n$$

63,750 people will vote.

51. **Strategy** To find the last year's dividend, solve the basic percent equation for the base, letting n represent the base. The percent is 80% and the amount is $1.60.

Solution

$$\text{Percent} \times \text{base} = \text{amount}$$
$$80\% \times n = 1.60$$
$$0.80 \times n = 1.60$$
$$n = 1.60 \div 0.80$$
$$n = 2.00$$

The dividend last year was $2.00.

52. **Strategy** To find the mean income for the 4 months, add the incomes and divide the sum by the number of incomes (4).

Solution

$$\begin{array}{r} 4320 \\ 3572 \\ 2864 \\ +\ 4420 \\ \hline 15,176 \end{array} \qquad 4\overline{)15,176} \quad 3794$$

The mean income is $3794.

53. **Strategy** To find the simple interest due, multiply the principal ($120,000) by the interest rate by the time (in years).

Solution

$$\text{Interest} = 120,000 \times 8\% \times \frac{9}{12}$$
$$= 120,000 \times 0.08 \times \frac{9}{12}$$
$$= 7200$$

The simple interest due is $7200.

54. **Strategy** To calculate the probability:

- Count the number of possible outcomes.
- Count the number of favorable outcomes.
- Use the probability formula.

Solution There are 36 possible outcomes.

There are 12 favorable outcomes:

(1, 2), (2, 1), (1, 5), (5, 1), (2, 4), (4, 2), (3, 3), (3, 6), (6, 3), (4, 5), (5, 4), (6, 6).

$$\text{Probability} = \frac{12}{36} = \frac{1}{3}$$

The probability is $\frac{1}{3}$ that the sum of the dots on upward faces of the two dice is divisible by 3.

55. Strategy To find the percent:

• Read the graph and find the death count of China.

• Read the circle graph and find the death count of the other three countries.

• Find the sum of the death counts by adding the four death counts.

• Solve the basic percent equation for percent. The base is the sum of the four death counts and the amount is the death count of China.

Solution

China:	1300 thousand
Japan:	1100 thousand
USSR:	13,600 thousand
Germany:	+ 3300 thousand
	19,300 thousand

Percent × base = amount

$$n \times 19{,}300 = 1300$$

$$n = 1300 \div 19{,}300$$

$$n \approx 0.067$$

China has 6.7% of the death count of the four countries.

56. Strategy To find the discount rate:

• Subtract the sale price ($226.08) from the regular price ($314) to find the amount of the discount.

• Use the basic percent equation for percent. The base is the regular price and the amount is the amount of the discount.

Solution

$$\begin{array}{r} 314.00 \\ -\,226.08 \\ \hline 87.92 \end{array}$$

Percent × base = amount

$$n \times 314 = 87.92$$

$$n = 87.92 \div 314$$

$$n = 0.28 = 28\%$$

The discount rate for the headphones is 28%.

57. Strategy To find the weight of the box in pounds:

• Multiply the number of tiles in the box (144) by the weight of each tile (9 oz) to find the total weight of the box in ounces.

• Convert the weight in ounces to the weight in pounds.

Solution

$$144 \times 9 \text{ oz} = 1296 \text{ oz}$$

$$1296 \text{ oz} = 1296 \text{ } \cancel{\text{oz}} \times \frac{1 \text{ lb}}{16 \text{ } \cancel{\text{oz}}}$$

$$= \frac{1296}{16} \text{ lb}$$

$$= 81 \text{ lb}$$

The weight of the box is 81 lb.

58. Strategy To find the perimeter of the composite figure, add the sum of the two sides to $\frac{1}{2}$ the circumference of the circle.

Solution

$$\text{Perimeter} = 2s + \frac{1}{2}\pi d$$

$$\approx 2(8 \text{ in.}) + \frac{1}{2}(3.14)(8 \text{ in.})$$

$$= 16 \text{ in.} + 12.56 \text{ in.}$$

$$= 28.56 \text{ in.}$$

The perimeter is approximately 28.56 in.

59. **Strategy** To find the area of the composite figure, subtract the area of the two half circles from the area of the rectangle.

Solution

$$\begin{aligned}
\text{Area} &= \text{area of rectangle} \\
&\quad - 2\left(\frac{1}{2}\text{area of circle}\right) \\
\text{Area} &= \text{length} \times \text{width} \\
&\quad - 2\left[\frac{1}{2}\pi(\text{radius})^2\right] \\
&\approx 10\text{ cm} \times 2\text{ cm} \\
&\quad - 2\left[\frac{1}{2}(3.14)(1\text{ cm})^2\right] \\
&= 20\text{ cm}^2 - 2\left(1.57\text{ cm}^2\right) \\
&= 20\text{ cm}^2 - 3.14\text{ cm}^2 \\
&= 16.86\text{ cm}^2
\end{aligned}$$

The area of the composite figure is approximately 16.86 cm^2.

60. The unknown number: n

$$\begin{aligned}
\frac{n}{2} - 5 &= 3 \\
\frac{n}{2} - 5 + 5 &= 3 + 5 \\
\frac{n}{2} &= 8 \\
2 \cdot \frac{n}{2} &= 2 \cdot 8 \\
n &= 16
\end{aligned}$$

The number is 16.